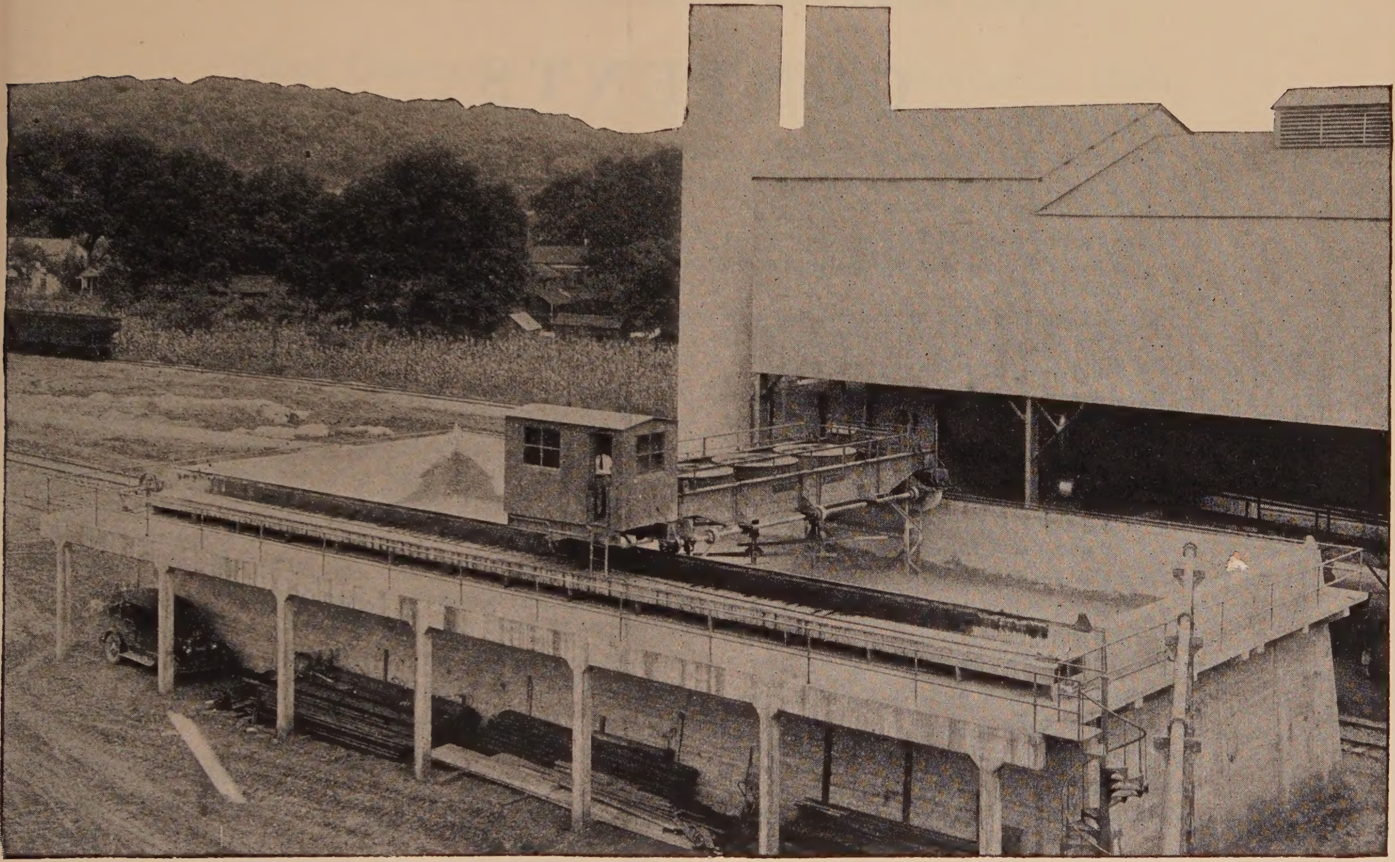
CEMENT MILL SECTION of

Concrete

AGITATORS

STORAGE BASINS MIX BASINS CORRECTING BASINS

MECHANICAL AND AIR AGITATION



FLS

Traveling Agitators with a total storage capacity of slurry sufficient for

233,845 barrels

of portland cement have been delivered to wet process plants in the United States and Canada.

The traveling platform carries the stirring arms and all operating machinery. The agitation is accomplished not only by the stirring arms but also by air which is injected into the mix through nozzles on the arms.

Low first cost, horsepower saving, reduction in upkeep and repairs are the advantages of the Traveling Agitator over the conventional stationary type of storage basin.

Mix basins and Correcting basins, equipped for both mechanical and air agitation, are included in the Smidth line of agitators for wet process portland cement plants.

F. L. SMIDTH & CO.

Engineers

225 Broadway New York, N. Y.

Designers and Equippers of Cement Making Factories

CEMENT MILL SECTION of

Concrete

The Cement Mill Edition of Concrete is edited exclusively for those interested in the manufacture of portland cement. Its pages are devoted to discussions of plant design, management, operation, production efficiency, chemical research and control, quarry operation, progress and news of the industry.

The Cement Mill Edition also contains all the material published in the corresponding Regular Edition and so provides news of the uses and merchandising of the materials whose manufacture is discussed in the Mill Edition. The Regular Section furnishes mill operating officials and mill executives valuable points of contact with the users of the materials they produce.

Volume 39 July, 1931 Number 1

CONTENTS

Tests Show Hot Cements Not Harmful to Normal Concrete *(Illus.)* 59
Alton J. Blank tells of his study and findings on the subject, dealing principally with the heat generated in setting and hardening.

Finding Undeveloped Sources of Fuel for Cement Plants 62
E. T. Ellis discusses additional American lignite deposits and methods for improving them for use.

Rapid Determination of Magnesium in Portland Cement 65
J. C. Redmond and H. A. Bright describe rapid and accurate method of procedure for the chemist to follow.

Editorial 69
Disposing of Michigan's White Elephant.
No Time for Smug Assurance.
Making Trophy Dedications Outstanding Events.

Detailed Story of Operating Methods at Giant's Reliance Quarry *(Illus.)* 70
Continuing S. G. McAnally's description of operations with the details of crushing, drying, mixing, and grinding.

The Use of Parallel Connections for Electric Blasting *(Illus.)* 75
Charles S. Hurter tells how parallel connections are made and amount of power current required.

New Books and Pamphlets 77

Cement Statistics for May *(Illus.)* 78

Men and Mills 79
News briefs about men in the industry.

Mill Equipment *(Illus.)* 80

About the Manufacturers of Equipment 82

Copyright, 1931, by Concrete Publishing Co.

INDEX TO ADVERTISEMENTS

Allis-Chalmers Mfg. Co. 83
Autocar Co. Back Cover
Burrell Engr. & Const. Co. 88
du Pont de Nemours & Co., Inc. 87
Engineering & Designing 54
Goodyear Tire & Rubber Co. 81
Kritzer Co., The 54
Link-Belt Co. 84-85
Smidth, F. L., Co. 57
Super Cement Co., The 56

CEMENT MILL SECTION of
Concrete

Vol. 39 Chicago, July, 1931 No. 1

Tests Show Hot Cement Not Harmful to Normal Concrete

Heat Generated in Setting and Hardening Is Main Subject of Study—Varies with Chemical Composition, Degree of Burning, and Fineness

By ALTON J. BLANK
General Superintendent and Supervising Chemist, Compania de Cemento Portland "Landa," S. A., Puebla, Puebla, Mexico

HOT cements are usually classified as (a) those which are hot to the touch and (b) those which, upon being gauged with water, develop an increase in temperature during the setting and hardening process. Cements coming under the former classification are those which derive their heat mainly from contact with the lining and grinding media in their passage through the preliminary and fine grinding cement mills. The temperature of the clinker entering the mills, the toughness of the clinker and the duration of the grinding process are all contributing factors; and where the average temperature of cements discharged from mills ranges between 100 and 125 deg. C., certain cements are found with temperatures of 200 deg. C. and higher.

May Retain Heat Many Months

The writer has found cement stored in large bins and silos to retain the heat developed during grinding for periods of six months and longer, while cements freshly sacked have usually been found to assume atmospheric temperatures within 24 to 48 hrs. of storage in the open.

Cements of this nature used for concrete-making purposes while hot have been found to require a slightly larger amount of mixing water than would be required were the cements comparatively cool. Incidentally, a somewhat longer mixing period is required for the concrete. Quite often when hot cements are used with normal amounts of mixing water and concrete mixed for normal periods, a "false set" develops. However, a slight excess in the amount of mixing water, together with a somewhat longer mixing period, remedies this effect without any detrimental effect upon the strength and durability of the concrete.

Cements are rarely shipped fresh from the mills, as one to two months' supply of cement is usually kept on hand in the average plant storages.

Conclusions as to Origin of Heat

The causes for the generation of heat in cements coming under the latter classification are to be found in the chemical composition of the cement, the degree and duration of burning to which the cement has been subjected in its passage through the kiln, and to the fineness to which the cement has been ground or separated.

Tests made by the writer upon a number of cements of varying compositions, varying degrees and periods of burning, and variations as to fineness, have resulted in the conclusions given in the next paragraph.

Those cements which show a marked rise in temperature upon being gauged with water are (a) those which have the lower silica alumina and the lower lime silica-alumina-iron oxide ratios; (b) those which have been subjected to higher temperatures and longer burning periods; and (c) those which have been pulverized or separated to extremely high finenesses.

Test Data and Procedure

Tests performed by the writer upon a standard portland cement over a period of several months have confirmed these conclusions and have resulted in the formulation of certain interesting data which are given herewith. Test data are as follows:

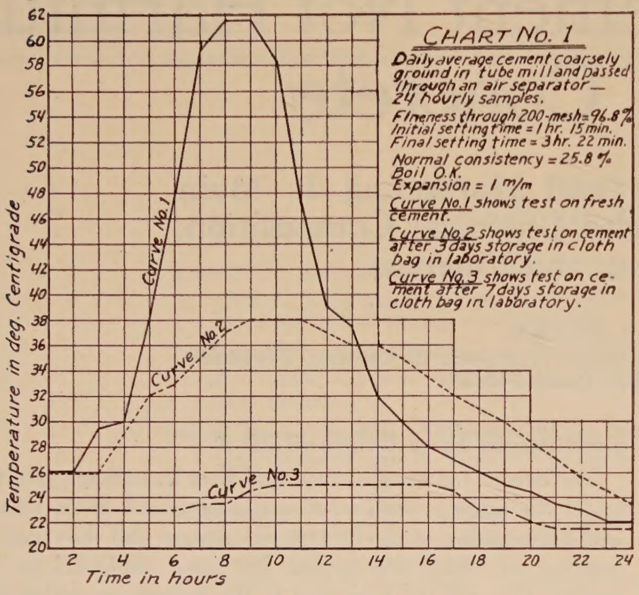
1. Cements tested consisted of 24 hourly samples made up to form an average, whether taken from the fine discharges of tube mills or air separators.
2. Neat cement 8 by 8-in. cylinders were made up with the amount of mixing water shown to be required from normal consistency tests made upon each sample.
3. Thermometers were inserted in the center of the cylinder test pieces and temperature readings were taken hourly over a period of 24 hrs. Test speci-

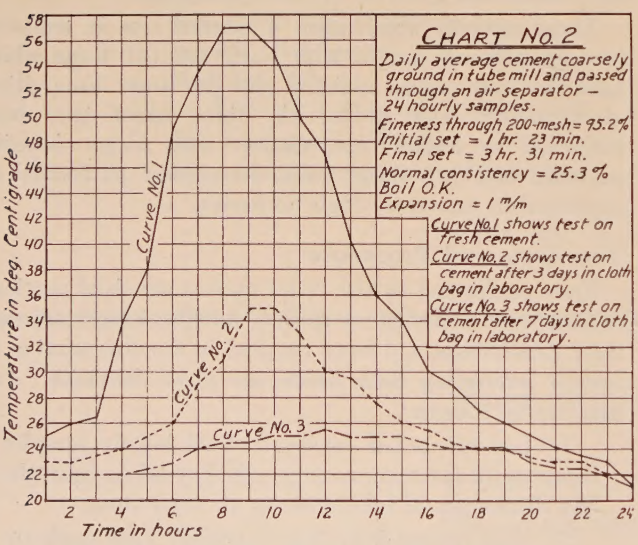
mens, due to shortage of space in temperature-controlled damp closets, were stored upon a shelf in the laboratory where room temperatures varied between 18 and 24 deg. C.

4. Tests for fineness, normal consistency, setting times, soundness, expansion and tensile strength, together with chemical analyses, were made upon each test sample of cement.

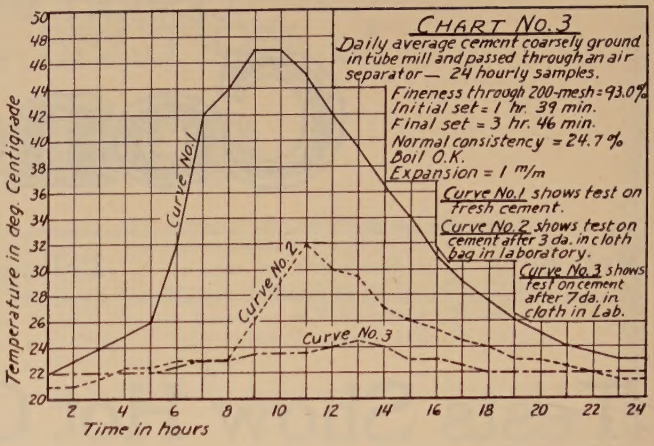
Inasmuch as the results obtained on the various tests were found to be more or less uniform, only a few of the results have been plotted.

Charts Nos. 1 to 4, inclusive, show temperature increases in four average cements, each of which had been subjected to comparatively coarse grinding, 35.0 per cent through the No. 200-mesh screen, before being sent to air separators where the fines were thrown out and the coarse rejections returned to the mill for further reduction. Adjustments were made upon the air separators to give the desired fineness.

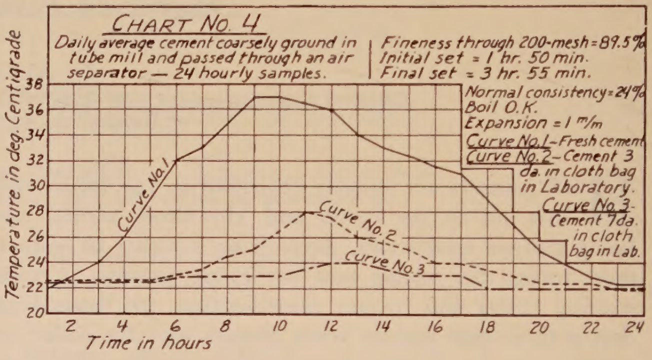




Charts Nos. 5 to 8, inclusive, show temperature increases in four average cements, each of which had been subjected to comparatively coarse grinding, 25.0 per cent through the No. 200-mesh sieve, in preliminary grinding mills before being reduced to the desired fineness in fine grinding tube mills.

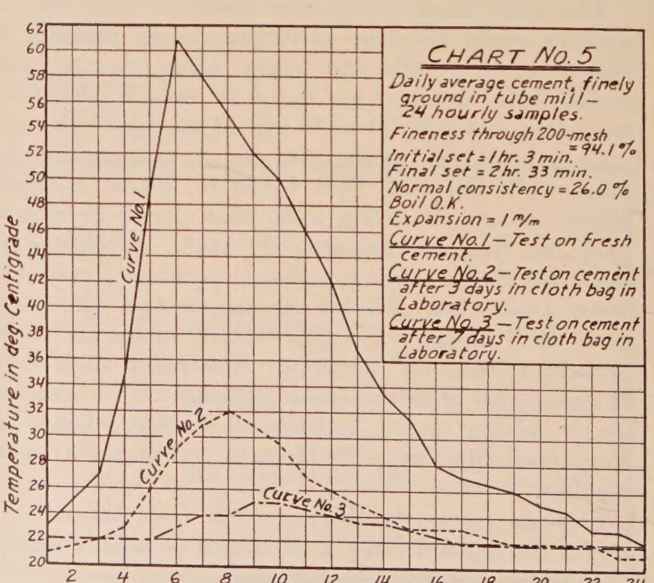


During the tests under study, the cement ground was from water-cooled clinker which had been stored in outside storage for a period of one week before being sent to the mills.



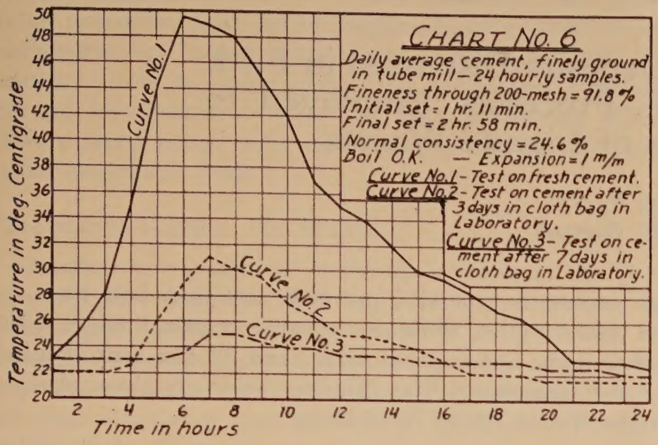
Significance of Test Results

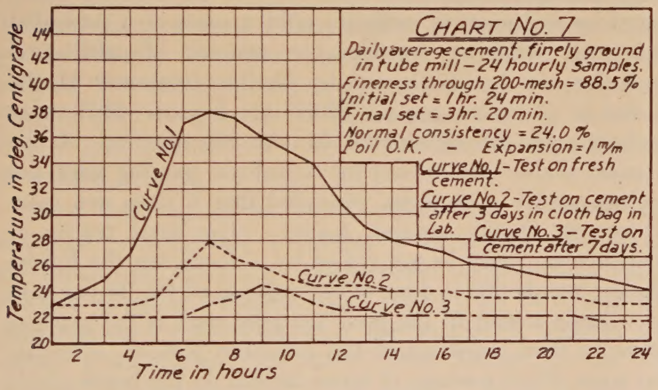
Perusal of the curves plotted show the rise in temperature of the cements during the setting and hardening period to be somewhat greater for a given fineness for those cements which were ground in the mills to their final



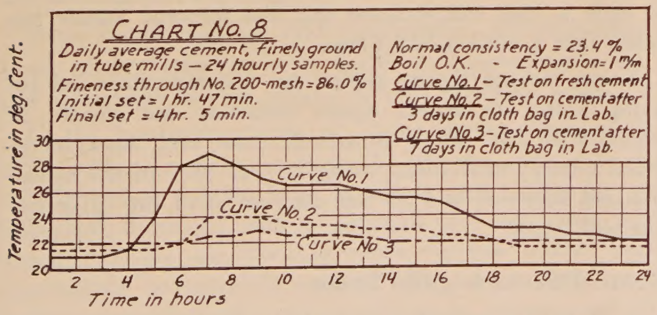
finenesses, when compared with those cements separated to their final finenesses.

In all tests the maximum rise in temperature was reached 4 to 6 hrs. after the final setting time of the cement had taken place. However, it is found that those cements ground to their final fineness in the tube mills had their maximum rise in temperature some 2 to 3 hrs. sooner than was experienced with those cements which were air-separated to their final finenesses. The decrease in heat developed during the setting and hardening of all cements, whether ground or separated to their final finenesses, was found to be more or less the same after storage periods of 3 to 7 days in cloth bags in the laboratory.





In all tests the rise in temperature was found to be more or less in proportion to the fineness of the cement, this also being true in so far as normal consistency and setting tests were concerned.



Analysis of Cements Tested

Chemical analyses of the cements under study were found to be more or less uniform, and for that reason only an average analysis of the cements is given in Table 1.

TABLE 1

Average Chemical Analysis of Cements Tested

	Per Cent
SiO_2	21.62
Al_2O_3	7.23
Fe_2O_3	2.17
CaO	62.91
MgO	2.67
SO_3	2.13
Loss	1.04

Average tensile strengths of the cements tested show that, notwithstanding the fact that the air-separated cements were some 3 per cent finer than the mill-ground cements, the strengths of the former cements were some 10 per cent lower at all ages. The average strengths are given in Table 2.

TABLE 2

Average Tensile Strengths of Cements Tested

1:3 Sands

	Tensile Strength, Lb. per Sq. In.	
Age at Test	Mill-Ground Cements	Air-Separated Cements
24 hours	161	152
3 days	286	259
7 days	328	301
28 days	447	403

All of the above tests were made upon fresh cements.

Cements which showed maximum temperature increases when gauged with water and made into neat specimens, when used in normal 1:2:4 to 1:3:6 concrete mixtures, failed to show any extraordinary generation of heat during the setting and hardening of the concrete. These observations of concrete construction ranged from the fabrication of thin concrete roof slabs and pillars to large foundation slabs.

Inspection of this concrete work from time to time has shown no development of cracks or other disturbances which would suggest that these "hot cements," when used for normal concrete-making purposes, act differently from the normal cool cements.

Pacific Coast Cement Leases Properties to Superior Portland

As the result of a lease signed on June 4 for five years and renewable for a similar period at the end of that time, Superior Portland Cement Incorporated has undertaken the operation of the properties of the Pacific Coast Cement Company.

Forty per cent of the net operating earnings resulting from the combined operations of the two plants will be paid as rental for the property. Combined capacity of the two concerns is approximately 2,800,000 barrels.

Finding Undeveloped Sources of Fuel for Cement Plants

Additional American Lignite Deposits Discussed in Fifth Article on Low Grade Fuels—Processes Employed to Improve Calorific Value of Lignite Wastes

By E. T. ELLIS, F. J. I.
Ecclesall, Sheffield, England

In this article, the fifth of a series dealing with the use of so-called low grade fuels in cement manufacture, the author discusses the possibilities of a number of lignite deposits in the United States in addition to those covered in last month's issue.—The Editors.

IN the June installment of this series the writer described lignite deposits in Alabama, Alaska, Arkansas, California and Louisiana, and explained the modus operandi necessary to improve their composition and thereby render them useful fuels in the manufacture of cement.

This article covers similar deposits of lignite in other parts of the United States.

Montana Lignite Slack

It is hardly necessary to discuss a detailed analysis of Montana lignite slack, as it resembles in composition North Dakota lignite shale, discussed in the next section, though as a rule it is rather more finely divided. The high moisture content is a characteristic feature, but this is reducible by pressure and by hot air drying. When these two steps have been taken, the next and final one consists of briquetting it with coal pitch, and firing the briquettes direct in the larger furnaces of the cement mill; or if pulverized fuel is wanted in increased quantities, these briquettes must be carbonized and the lignite slack coke ground up and mixed with hard coal dust.

North Dakota Lignite Shale

Any of the better grades of North Dakota lignite shales are relatively good and comparatively cheap compared with other cement mill fuels. In the poor samples the fixed carbon content is about 24 per cent, while the volatile matter content is around 25 per cent. The ash content of the poor samples is never very great, and 11 per cent is a suitable constant to give to those who offer the shale to you. The moisture content, however, in the poor samples is round about 39 per cent, but can be greatly reduced by suitable treatment.

In the better grades of North Dakota lignite shale the fixed carbon content is up to 30 per cent, and the volatile matter content rather more, or about 32 per cent. The ash content is around 5 per cent, less than half that of the poor samples, while the moisture content, though still rather high, is again reducible, and 32 per cent should be the maximum. The calorific value of these shales ranges from 6,700 to 7,100 B.t.u.

The modus operandi is comparatively simple in this particular case. Not much mineral matter can be eliminated by sorting along an endless band arrangement or by sifting unless the shale is very coarse in character, in which case lumps of unburnable material may be fairly readily recognized and thrown out. The reduction of the moisture content, therefore, is the feature that should be concentrated upon in making North Dakota lignite shales more usable than they are. Some moisture can be eliminated by treatment in ordinary cold presses of a powerful character, while a considerable amount of additional moisture can be eliminated by similar treatment of the shales in powerful presses which are heated. Still more moisture can be eliminated by the introduction of the pressed shales into air-drying chambers, passing very hot air repeatedly over them, provided that it does not volatilize any of the organic matter. The final traces of moisture can only be got rid of by carbonizing the lignite shales; but as this is done at the expense of the 25 per cent of volatile matter in the poor samples, and at the expense of more than one-third of the burnable portion, allowing for some slight wastage of fixed carbon, in the better grade samples, some will naturally hesitate about carrying it out. Actually, however, the carbonization of North Dakota lignite shales is a profitable operation when they are to be used extensively as cement works fuel, the coke from the good grade samples resembling other cokes and being more readily pulverizable, unless it has been heated to such a high temperature that the mineral matter has fused into a clinker-like glass.

North Dakota lignite shales are not recommended for firing alone in cement works furnaces, but should be mixed with coal slack, powdered coke, and other recognized cement mill fuels, using 25 per cent of the uncarbonized material and 50 per cent or so of the fully carbonized types.

South Dakota Lignite Shale

It is hardly necessary to discuss South Dakota lignite shales in detail in the present article, as most of these shales are similar in composition to the North Dakota lignite shale of which two analyses have been given above.

The modus operandi is again comparatively simple, and consists of very thorough drying. All the softer types of

South Dakota lignite shales should at once be briquetted by means of water gas pitch. These briquettes, which are comparatively hard if made in powerful mechanical presses, can be used for direct firing in the larger furnaces of cement mills; but if used in conjunction with other pulverized fuel, the briquettes should be thoroughly carbonized in large consignments. When all volatile matter ceases to come away, the carbonized material should be allowed to cool, and then ground up alone before being mixed with coal slack, powdered coke and other recognized fuels.

Tennessee Lignite Tip Waste

Another low grade fuel is the tip waste from the Tennessee lignite deposits. This is similar in composition to Mississippi lignite waste, and consists in the main of burnable material containing a fairly high ash content and a good deal of moisture. The volatile matter content of some samples is considerable, but this is an advantage rather than otherwise. In buying tip waste from the Tennessee lignite deposits samples showing 25 to 30 per cent of volatile matter should be specially watched for.

The modus operandi consists of very thorough, complete, but careful drying. This is the most important preliminary step, for it is hardly worth while passing the tip waste along an endless band arrangement until a quantity of its moisture has been eliminated, because some of the unburnable wet portions look very similar to the burnable wet portions. They appear quite different when partly dried. Complete drying can not, as a rule, be carried out without carbonization, because if sufficient heat is used to get rid of all the moisture the volatile matter gets ignited and some of the fixed carbon begins to oxidize.

After removal of as much moisture as possible by machine pressing and treatment in air-drying chambers, the remaining lignite tip waste should be briquetted with the aid of spent sulphite liquor, using this as strong as possible, and employing only the minimum amount to obtain a satisfactory briquette. These briquettes can be burnt in the larger furnaces for stoking just as lumps of coal or coke are, for boiler work and for general steam raising purposes; but for the burning of cement itself they should be thoroughly carbonized, and then ground up before being mixed with coal slack or powdered coke.

Texas Lignite Tippings

Texas lignite tippings vary considerably in composition. Many of the types are quite usable as cement works fuel, and are nearly always offered at very tempting prices.

In the low grade types of Texas lignite tippings the fixed carbon content is down to 22 per cent, but the volatile matter content is up to 27 per cent. Here we are furnished, therefore, with an example of a low grade fuel which contains considerably more volatile matter than non-volatile combustible carbon. The ash content even in the worst samples is only moderate in amount, and 11 per cent should be the constant to specify. The moisture content unfortunately is apt to be very considerable in the poorest samples, and 35 per cent or even more may be revealed by ordinary analytical methods. Samples which show 47 per cent of combustible matter should never, however, contain more than 35 per cent of moisture, as otherwise the cost of exploiting them for use in cement manufacture will be too great.

Turning now to the higher grade types of these Texas lignite tippings, the fixed carbon content is sometimes as high as 34 per cent, or 12 per cent more than in the poorer samples. The volatile matter content in the best samples is rather less than the fixed carbon content, and is generally round about 33 per cent, which is 6 per cent more than in the poorer samples, and exerts a decided advantage, inasmuch as it brings the total combustible matter content up to 67 per cent, compared with 49 per cent in the low grade types. The ash content is rather less in the good grade samples, and 7 per cent should be the maximum. The moisture content, while still high, is again substantially less in the high grade than in the low grade samples, and 31 per cent should be the absolute maximum. The calorific value of the poorest types of Texas lignite tippings is round about 7,000 B.t.u., while that of the highest grade samples is round about 8,000. Occasionally samples are met with which will show a calorific value of 8,500 B.t.u.

The modus operandi consists first of all of reducing the moisture content as far as possible by pressure in the cold, pressure under heated conditions, and air-drying in suitable chambers. The heat must not be high enough to reduce the volatile matter content. When this has been done, all the tippings should be passed along an endless band arrangement, in order that coarse pieces of unburnable rocks or siliceous shale can come out. All the softer types of Texas lignite tippings should at once be briquetted by means of water gas pitch, coal pitch, or wood pitch. These briquettes, provided that they are made in powerful mechanical presses, can be used for direct stoking with other lump fuel in the bigger furnaces, but should be carbonized thoroughly if they are wanted for direct cement burning, the coked bricks then being ground up and mixed with coal slack or pulverized coke in the usual way.

Western States Lignite Waste

A mixed lignitic waste from various states is known collectively as Western States lignite waste. The composition of this is subject to wide variation, and there is no doubt that some of it consists mainly of unburnable rubbish. On the other hand, there are good lignite wastes available. These should show on analysis the presence of about 34 per cent of fixed carbon.

The volatile matter content should also be examined carefully. A suitable constant to keep in mind is 25 per cent, although many of the samples contain much less, and a few may contain rather more. The ash content in nearly all samples of Western States lignite waste is surprisingly low, and not more than 5 per cent is permissible. The moisture content, on the other hand, is relatively high, and many a parcel will contain fully 35 per cent of water, though I would never buy parcels containing more than this quantity. Much of the moisture is, however, relatively easy to remove, and this means that cement executives are able to obtain a fuel of a relatively high combustible character at a small cost. The calorific value of samples of Western States lignite waste of the above composition is usually round about 7,500 B.t.u.

The modus operandi does not differ greatly from that already outlined in the case of several of the other lignitic fuels of which analyses have been given. The most important step of all is obviously to get rid of the major portion of the moisture. Some claim that it is possible to reduce this to 5 per cent without any loss of volatile matter, or oxidation of fixed carbon. In many instances, however, it is only possible to get rid of 25 per cent of moisture without risk of serious loss.

Having reduced the bulk of the fuel by air-drying, pressure, and other means by 25 per cent, the next thing to consider is whether it is advisable to pass the material along an endless band arrangement. With an ash content as low as 5 per cent it is questionable whether the time could not be better expended in another direction; but if Western States lignite waste is very coarse in character, occasionally such band sorting is a profitable operation. If the lumps are most carefully scrutinized, and the band is operated slowly, the 5 per cent of incombustible matter can be recognized and thrown off. This can not be done with finely divided waste, or with soft stuff which breaks up as soon as pieces are handled.

Western States lignite waste, if it is to be used for actual cement burning, should as a rule be briquetted and carbonized. In order to increase its fixed carbon content, and also at the same time to release a higher proportion of gaseous substances during carbonization, the well dried fuel can be mixed with dry sawdust up to 33⅓ per cent of its own bulk immediately prior to briquetting. When these bricks are carbonized, a mixture of wood gas and lignite gas comes away, and the residue in the retorts consists of a mixture of lignite charcoal and wood charcoal, which gives out a big quantity of heat when mixed with coal slack or coke dust after being coarsely ground up. This method is only applicable, of course, to cement corporations who operate in the vicinity of sawmills, and who are able, therefore, to obtain big supplies of sawdust regularly.

Wyoming Lignite Bank Batts and Shale

Lastly, a word or two may be said in regard to the bank batts and shale from the Wyoming lignite deposits. Although there are very poor samples in the market, many of the better types resemble North Dakota lignite shale very closely in composition, containing up to 30 per cent of fixed carbon and round about 32 per cent of volatile matter.

Cement executives who wish to make use of Wyoming lignite bank batts and shale should give instructions that the material is to be dried either at the point of production or immediately on arrival. The harder stuff can then be sorted by passage along an endless band arrangement, batts consisting of unburnable shale can be recognized, as a rule, and thrown out. Many of these bank batts, however, consist partially of lignite and partially of shale, and band sorters should be given definite instructions to break them up on tables adjoining the band, and then throw the broken mass on to the arrangement again for the sorter and subsequent operators to pick over. Unless instructions are given, the average band sorter throws out many batts which contain quite appreciable quantities of burnable matter, and the spoil banks increase much more rapidly than they should.

If much breaking up is done in the manner indicated it is advisable to dry the refuse again after it falls off the band as this turns back. When this has been done, the whole consignment should be briquetted, using water gas pitch or some other similar cheap and easily obtainable binding agent, and employing powerful mechanical presses which are slightly heated for the operation. These briquettes can be used in the cement works just as they are, like lump coal, for direct firing in the boiler house; but for the actual operation of cement burning I always advise the bricks being carbonized in suitable retorts, collecting the gases which come over, for independent use or sale. Some of the harder types of Wyoming lignite bank batts and shale yield quite a dense coke. This should be quenched rapidly, avoiding excess of water, and then ground up along with coal slack or coke of the kind ordinarily employed in the cement mill, and fired in as dry and finely divided a condition as is reasonably possible.

Feiker Is Appointed Head of U. S. Commerce Bureau

Frederick M. Feiker, managing director of the Associated Business Papers, Inc., since 1927, has been designated by President Hoover as director of the Bureau of Foreign and Domestic Commerce, Department of Commerce. He will succeed William L. Cooper who will go to London as commercial attache.

Shortly after Mr. Hoover became Secretary of Commerce in 1921, the McGraw-Hill Publishing Company acceded to his request to lend him the services of Mr. Feiker for the purpose of developing the contacts of the Department of Commerce with business and trade. Mr. Feiker organized the commodity divisions in the Bureau of Foreign and Domestic Commerce and recruited a personnel especially qualified to direct that part of the work. He assisted in the establishment of the Simplified Practice Division and helped organize the Survey of Current Business.

Mr. Feiker is the first director in the history of the Bureau of Foreign and Domestic Commerce who has not made foreign trade his principal specialty. His appointment emphasizes the fundamental change gradually being made in the Bureau, under which additional attention is being given the problems of domestic commerce.

Mr. Feiker is perhaps best known for his work, extending over a period of eight years, as an editor and later as editorial director and vice-president of the McGraw-Hill Company. Prior to his services with the McGraw-Hill publications he was chairman of the editorial board of the A. W. Shaw Publishing Company.

For the past four years Mr. Feiker has been managing director of the Associated Business Papers, the organization of publishers in the business field for the United States and Canada.

Harold J. Payne, who has been for the past year assistant managing director of the Associated Business Papers, has been appointed by its executive committee as secretary.

Regular Quarterly Dividend Paid by Ideal

The Ideal Cement Company on July 1 was to pay its regular quarterly dividend of 75 cents a share on common stock, a total of $343,703.25, and at the same time $103,650 on its debentures, a total of $447,353.25.

Rapid Determination of Magnesium in Portland Cement

Use of Reagent 8-Hydroxyquinoline Is Accurate and Much More Rapid Than Standard Phosphate Method—Discuss Methods of Procedure

By J. C. REDMOND and H. A. BRIGHT

Abstract—The precipitation of magnesium by the use of the reagent 8-hydroxyquinoline and titration of the acid solution of the precipitate with standard bromate-bromide solution have been studied. A procedure is given for determining magnesium in portland cement. The method is accurate and much more rapid than the standard phosphate method.

These investigators have developed a method for the determination of magnesium in portland cement that will require not more than 1.5 to 2 hours of an experienced chemist's time. The recommended procedure for portland cement is described in detail and in full below under "The Method for Portland Cement."

This important contribution to the subject is reprinted in full, from the Bureau of Standards Journal of Research, January, 1931.—The Editors.

IN the method used most commonly for the determination of magnesium the latter is precipitated as magnesium ammonium phosphate. To obtain accurate results the solution containing the precipitate must be allowed to stand three to four hours and furthermore reprecipitation[1] is necessary.

The maximum amount of magnesia (MgO) allowed by Federal specification 1a and the Standard Specification for Portland Cement (C 9-30) of The American Society for Testing Materials is 5.00 per cent (plus a tolerance of 0.4 per cent permitted by A.S.T.M. standard C 77-30). Since a great deal of cement is purchased under these specifications, it follows that many determinations of magnesia are required. At present the phosphate method is standard, and is quite accurate and applicable for umpire analyses, but it is rather lengthy. Hence a more rapid procedure for the determination of magnesium in portland cement is desirable, especially for routine work. The work of Berg and others indicated that 8-hydroxyquinoline might be used to advantage in a rapid method for this determination, and accordingly the use of this reagent for precipitating magnesium was investigated.

Based on the results of the study a procedure has been developed for determining magnesium in portland cements and similar materials containing not more than 5.4 per cent magnesia. In the method described, the magnesium is precipitated with 8-hydroxyquinoline and the acid solution of the precipitate is titrated with a standard solution of potassium bromate-bromide.

GENERAL CONSIDERATIONS

A number of papers have been published recently on the use of 8-hydroxyquinoline for the separation and determination of certain elements.[2] Berg states that magnesium may be precipitated in the presence of iron and aluminum in a sodium hydroxide-sodium tartrate solution. Calcium, however, accompanies the magnesium in this separation. Berg further shows that magnesium may be precipitated in the presence of calcium in a faintly ammoniacal solution, but his data indicate that reprecipitation is always necessary. These facts show that no saving of time could be made by the use of these procedures and hence it is preferable to remove the iron and aluminum with ammonium hydroxide and the calcium with ammonium oxalate as is done in the standard methods.

Rapid determinations of calcium in portland cement can be made by direct precipitation of calcium by oxalic acid,[3] in the presence of iron and aluminum. Whether a direct precipitation of magnesium by 8-hydroxyquinoline can be made in the filtrate from such a separation of calcium was not investigated at this time. In the work discussed herein, the usual methods of separating iron and aluminum with ammonium hydroxide and calcium with ammonium oxalate were employed.

The determination of magnesium by the use of 8-hydroxyquinoline is based on the fact that magnesium and 8-hydroxyquinoline combine in dilute ammoniacal solution to form an insoluble compound, magnesium oxyquinolate, $Mg(C_9H_6ON)_2.2H_2O$. The precipitate is crystalline and is easily filtered and washed. It may be weighed[4] as anhydrous magnesium oxyquinolate after drying at 130 deg. to 140 deg. C., titrated according to Koppenschaar's method for the titration of phenol,[5] or ignited under a cover of oxalic acid to magnesium oxide.[6] The work reported in this paper was confined chiefly to the titration method, since it was found that under the proper conditions the results were as accurate as those obtained by weighing, and could be arrived at much more rapidly.

---

[1] Hillebrand and Lundell, Applied Inorganic Analysis, Wiley & Sons, pp. 512-513.

[2] Berg., *Z. Anal. Chem.*, 70, p. 34; 1927; 71, pp. 23, 369; 1927. Berg. *Pharm. Zeit.*, 1929. Hahn and Vieweg. *Z. Anal. Chem.*, 71, p. 122; 1927. J. Robitschek, *J. Am. Cer. Soc.*, 11, p. 587; 1928. Lundell and Knowles, *B. S. Jour. Research*, 3, p. 91; 1929.

[3] R. K. Meade, Portland Cement, p. 189; 1906.

[4] In which case the precipitate should be filtered on a Jena glass or Gooch crucible.

[5] Koppenschaar, *Z. Anal. Chem.*, 15, p. 223; 1876.

[6] Hillebrand and Lundell, Applied Inorganic Analysis, Wiley & Sons, p. 115.

Two different procedures for the precipitation of magnesium oxyquinolate are described by Berg.[7] In the first of these, the solution of the magnesium salt, containing sufficient ammonium chloride or acetate to prevent the formation of magnesium hydroxide, is made distinctly ammoniacal by adding an excess of several milliliters of concentrated ammonium hydroxide, warmed to 60 to 70 deg. C., and the magnesium precipitated by adding a small excess of 2 per cent alcoholic or acetic acid solution of 8-hydroxyquinoline while the solution is gradually heated to the boiling point. The presence of an excess of reagent is indicated by the appearance of a yellow color in the solution. After settling, the precipitate is filtered, washed with hot dilute ammonium hydroxide (1 per cent), and either dried and weighed, or dissolved in acid and titrated. This procedure is hereafter referred to as procedure 1. In the second procedure[8] an excess of 8-hydroxyquinoline solution is added to the acid solution containing the magnesium and sufficient ammonium salts to prevent the precipitation of magnesium hydroxide. The solution is then heated to boiling, and an excess (2 to 3 ml) of concentrated ammonium hydroxide is added. The supernatant liquid should be yellow. If not, more 8-hydroxyquinoline is added until the yellow color is obtained. After settling, the precipitate is filtered, and treated as in procedure 1. This procedure is designated hereinafter as procedure 2.

It will be noted that the essential difference between the two methods of precipitation is that in procedure 1 the magnesium is precipitated by adding the reagent to an ammoniacal solution while in procedure 2 ammonium hydroxide is added to an acid solution to which the reagent has previously been added.

EXPERIMENTAL STUDY

For studying the conditions affecting the precipitation of magnesium by 8-hydroxyquinoline various amounts of a standard solution of magnesium chloride were used. This standard solution was prepared from magnesium chloride of good reagent quality and was standardized by precipitating the magnesium as magnesium ammonium phosphate, reprecipitating, and igniting to the pyrophosphate. The titration procedure and the solutions of 8-hydroxyquinoline, potassium-bromide, etc., were those described later under the method for portland cement.

The results of preliminary tests showed that boiling the solutions was not entirely satisfactory in that the magnesium oxyquinolate tends to creep, and the reagent tends to volatilize, but that the elimination of the heating to boiling produced low results. Stirring was found to accelerate precipitation. It was noted that if a large excess of reagent was added results were high. It was further noted that the time required for complete precipitation was influenced by the conditions under which the 8-hydroxyquinoline was added.

A series of experiments was accordingly made in which the acid solution, containing an excess of 8-hydroxyquinoline, was made ammoniacal. All test solutions also contained ammonium salts and a small amount of ammonium oxalate to simulate the conditions under which the magnesium precipitation is usually carried out in the analysis of portland cement. Some of the tests were made exactly as described in procedure 2, while others, precipitated similarly, were digested for longer periods of time. All precipitations in this series and the following ones were made in a volume of about 350 ml, which is approximately that of the filtrate from the calcium determination in the analysis of portland cement. The results are given in Table 1.

In a second series of tests the 8-hydroxyquinoline reagent was added to the warm ammoniacal solution; that is, according to procedure 1. The results are shown in Table 2.

As previously mentioned, complete precipitation was obtained in much less time when the solutions were stirred. Furthermore, a much smaller excess of reagent was required for complete precipitation in a short time. It was observed, however, that high values were obtained when the hot ammoniacal solution was stirred and the 8-hydroxyquinoline added until a precipitate first appeared. Under these conditions, which correspond essentially to those of procedure 1, with the exception that stirring is substituted for "the heating to boiling," a considerable excess of reagent must be added before the precipitate begins to form. The results obtained when the heating

TABLE 1

Results for MgO Obtained by Adding an Excess of NH_4OH to an Acid Solution Containing 8-Hydroxyquinoline (Procedure 2)

Experiment No.	MgO taken	MgO found	Error	Reagent added	Approximate reagent required	Approximate excess	Remarks
	g	*g*	*g*	*ml*	*ml*	*ml*	
1	0.0048	0.0036	—0.0012	20	3	17	Filtered 15 minutes after addition of reagent.
2	.0120	.0081	—.0039	20	7	13	
3	.0288	.0241	—.0037	20	17	3	
4	.0048	.0037	—.0011	20	3	17	Solution digested for 1 hour on steam bath.
5	.0120	.0112	—.0008	20	7	13	
6	.0288	.0273	—.0015	20	17	3	
7	.0048	.0047	—.0001	20	3	17	Solution digested for 2 hours on steam bath and then allowed to stand at room temperature over night.
8	.0120	.0119	—.0001	20	7	13	
9	.0288	.0287	—.0001	20	17	3	

---

[7] *Z. Anal. Chem.*, 71, p. 27; 1927.

[8] *Pharm. Zeit.*; 1929.

TABLE 2

Results for MgO Obtained by Adding an Excess of 8-Hydroxyquinoline to an Ammoniacal Solution
(Procedure 1)

Experiment No.	MgO taken	MgO found	Error	Reagent added	Approximate reagent required	Approximate excess
	g	*g*	*g*	*ml*	*ml*	*ml*
10	0.0048	0.0043	—0.0005	20	3	17
11	.0049	.0048	—.0001	28	3	25
12	.0120	.0115	—.0005	20	7	13
13	.0121	.0115	—.0006	22	7	15
14	.0121	.0120	—.0001	32	7	25
15	.0121	.0123	+.0002	40	7	33
16	.0170	.0166	—.0004	31	10	21
17	.0288	.0272	—.0016	20	17	3
18	.0291	.0294	+.0003	31	17	14
19	.0291	.0293	+.0002	40	17	23
20	.0291	[1].0297	+.0006	20	17	3

[1] Stirring substituted for boiling.

to boiling was replaced by stirring in procedure 2 were satisfactory, since only small positive errors were noted with the same excess of reagent that caused large errors in the previously mentioned case. This latter method will be designated as procedure 3, and is carried out as follows: All of the reagent is added to a warm (60 to 70 deg. C.) neutral or faintly ammoniacal solution, and an excess of ammonium hydroxide of 3 to 4 ml per 100 ml of the solution is added. The solution is then stirred for 10 minutes. The results obtained by this method of precipitation, procedure 3, are given in Table 3.

TABLE 3

Results for MgO Obtained by Adding an Excess of 8-Hydroxyquinoline Reagent to the Neutral (or Slightly Ammoniacal) Solution at 60 Deg. to 70 Deg. C., Then a 3 to 4 Per Cent Excess of NH_4OH, Then Stirring for 10 to 15 Minutes
(Procedure 3)

Experiment No.	MgO taken	MgO found	Error	Reagent added	Approximate reagent required	Approximate excess
	g	*g*	*g*	*ml*	*ml*	*ml*
21	0.0048	0.0052	+0.0004	20	3	17
22	.0120	.0123	+.0003	20	7	13
23	.0120	.0129	+.0009	35	7	28
24	.0123	[1].0124	+.0001	32	7	25
25	.0170	.0172	+.0002	20	10	10
26	.0240	.0260	+.0020	40	14	26
27	.0224	[1].0223	+.0001	40	14	26
28	.0288	.0288	.0000	20	17	3

[1] Precipitate dried 1 hour at 130 deg. to 140 deg. C. before titration.

Passing on to a further consideration of the data given in Tables 1, 2, and 3, the following will be observed: In Table 1 experiments 1 to 3 show that with 20 ml. of the 8-hydroxyquinoline solution (1.25 per cent) complete precipitation of magnesium was not secured in 15 minutes when the acid solution of magnesium and 8-hydroxyquinoline is treated with ammonium hydroxide (procedure 2). With additional digestion and long standing, precipitation is complete. Twenty milliliters of the reagent 8-hydroxyquinoline is theoretically more than sufficient to precipitate from an 0.5 sample, the maximum amount of magnesia (5.4 per cent) allowed by either the Federal specification No. 1a for portland cement, or The American Society for Testing Materials Specification for Portland Cement (C 9-30).[9]

In Table 2, experiments 10, 12, and 17 also show that 20 ml. of 8-hydroxyquinoline reagent is not sufficient to secure complete precipitation of magnesium when the 8-hydroxyquinoline reagent is added to the ammoniacal solution (procedure 1), though precipitation is more nearly complete than in the case when ammonium hydroxide was added to the acid solution of magnesium containing the 8-hydroxyquinoline reagent. Increasing the excess of reagent aids in securing complete precipitation within a short time. With an excess of approximately 25 ml. of 8-hydroxyquinoline reagent small amounts of magnesium are completely precipitated by procedure 1 (experiments 11, 14, and 19). Furthermore, this excess of reagent does not introduce any serious positive error when 0.0291 g. of magnesia are present as shown by experiment 19. With a cement of unknown magnesium content, it is therefore possible, when using this procedure, to add from 35 to 40 ml. of the reagent, thereby insuring complete precipitation for cements low in magnesia and at the same time introducing no serious positive error for those cements approaching the maximum amount (0.0270 g. for a 0.5 sample) of magnesia allowed by the standard specifications. A comparison of the results of experiments 17 and 20 shows the effect of stirring in hastening complete precipitation. A further comparison of experiment 20 with 28 shows the positive error introduced by the stirring procedure when the 8-hydroxyquinoline reagent is added to a hot ammoniacal solution.

In Table 3, it will be noted (experiment 28) that 20 ml. of the 8-hydroxyquinoline reagent is sufficient to precipitate 0.0288 g. of magnesia when added to a neutral or faintly ammoniacal solution, followed by the addition of an excess of 3 to 4 per cent of ammonium hydroxide and stirring of the solution for 10 to 15 minutes (procedure 3). Excess reagent apparently tends toward larger positive errors in this procedure (procedure 3). As indicated in experiments 21, 22 and 25, the error, when 20 ml. of reagent is added, is negligible for commercial analyses. These positive errors are probably due to occluded reagent and can be avoided if the precipitate is dried at 130 deg. to 140 deg. C. before it is weighed or titrated since 8-hydroxyquinoline is volatile at these temperatures. Experiments 24 and 27 support this view.

From the preceding discussion it is evident that less reagent is required for complete precipitation in a short time if the solution is stirred. Furthermore, in cases where the approximate magnesia content of a cement is not known, it is satisfactory to add 20 ml. of the reagent, since this amount gives satisfactory results for quantities of magnesia from 0.0048 to 0.0288 g. This procedure has accordingly been adopted in the method to be described. In this method silica need not be removed and only single precipitations of iron and aluminum, and of calcium are made. The very small amount of magnesia which may be occluded in the R_2O_3 and calcium precipitates is apparently compensated for by the tendency of the method to give results which are a few tenths of a milligram high.

The performance of the method is illustrated by the data given in Table 4. Since the bureau issues no standard analyzed sample of portland cement because of the inconstancy of the chemical composition of this material, and since the preparation of such a standard for this work would have involved a large number of determinations, samples of Bureau of Standards standard argillaceous

---

[9] A. S. T. M. Standards II, pp. 25 and 34; 1930.

TABLE 4

Results Obtained by Recommended Procedure on Standard Argillaceous Limestone No. 1a

Experiment No.	Weight of sample	MgO present g	MgO found g	Error g
29	0.5	0.0109	0.0108	—0.0001
30	.5	.0109	.0109	.0000
31	.8	.0175	.0174	—.0001
32	.8	.0175	.0176	+.0001
33	.8	.0175	.0176	+.0001
34	.8	.0175	.0177	+.0002

limestone No. 1a were used to test the results obtained with the method. This limestone, when ignited in a platinum crucible for 30 minutes at 1,100 deg. C., has a composition very similar to portland cement. After this ignition, the samples were dissolved in hydrochloric acid, and the magnesia was then determined by the recommended method. By using the method described below an experienced operator can determine magnesia in a portland cement or limestone in 1.5 to 2 hours.

THE METHOD FOR PORTLAND CEMENT

Solutions Required

Acetic acid solution of 8-hydroxyquinoline (1.25 *per cent*).—Dissolve 25 g. of 8-hydroxyquinoline in 60 ml. of glacial acetic acid. When solution is complete dilute to a volume of 2 liters with cold water. One milliliter of this solution is equivalent to 0.0016 g. of MgO.

Potassium bromate-bromide solution (0.2 *N*).—Dissolve 20.00 g. of potassium bromide and 5.57 g. of potassium bromate in 200 ml. of water and dilute to 1 liter. The ratio of this solution to the standard sodium thiosulphate solution is obtained as follows: To 200 ml. of water in a 400-ml. beaker add 20 ml. of hydrochloric acid (specific gravity 1.19) and then exactly 25 ml. of the potassium bromate-bromide solution. Add immediately 10 ml. of the potassium iodide solution and titrate with the standard sodium thiosulphate solution until the solution is nearly colorless. Then add 2 ml. of starch solution and titrate to the disappearance of the blue color.

Sodium thiosulphate solution (0.1 *N*).—Dissolve 25 g. of sodium thiosulphate ($Na_2S_2O_3.5H_2O$) in 200 ml. of water, and dilute to 1 liter. Standardize this solution with a 0.1 *N* solution of resublimed iodine. The iodine solution is standardized with Bureau of Standards standard sample of arsenious oxide No. 83. One milliliter of an exactly 0.1 *N* sodium thiosulphate solution is equivalent to 0.000504 g. of MgO.

Potassium iodide solution (25 *per cent*).—Dissolve 25 g. of potassium iodide in 100 ml. of water.

Starch solution.—Dissolve 5 g. of soluble starch and 2.5 g. of salicylic acid in 1 liter of water.

Procedure

To a 0.500 g. sample in a 400 ml. beaker add 10 ml. of water and 10 ml. of hydrochloric acid (specific gravity 1.19). Heat gently, and grind any coarse particles with the flattened end of a glass rod until decomposition is complete. Dilute to 150 ml. with hot water.

To the solution add three drops of methyl red indicator (0.2 per cent alcoholic solution), and then ammonium hydroxide (specific gravity 0.90) until the solution is distinctly yellow. Add macerated filter paper and heat to boiling. Boil for one to two minutes, remove from the hot plate, and allow the solution to stand until the precipitate has settled. Filter without delay and wash the precipitate thoroughly with a hot 2 per cent solution of ammonium chloride. To the filtrate add 1 ml. of ammonium hydroxide (specific gravity 0.90), and heat to boiling. When the solution is boiling, add 25 ml. of hot ammonium oxalate solution (4 per cent), and continue the boiling for two or three minutes. Digest on the steam bath for one-half to one hour and then filter and wash five or six times with warm water. The volume of the filtrate at this point should be about 350 ml.

Heat the filtrate to 60 to 70 deg. C. and add[10] 20 ml. of the 8-hydroxyquinoline solution, and then 4 ml. of ammonium hydroxide per 100 ml. of solution. Stir on a mechanical stirring machine for 10 to 15 minutes and set aside until the precipitate has settled. Filter and wash with hot dilute ammonium hydroxide (1:40). Dissolve the precipitate in 50 to 75 ml. of hot dilute hydrochloric acid (1:9), dilute the resulting solution to 200 ml., and add 15 ml. of hydrochloric acid (specific gravity 1.19). Cool to 25 deg. C. and add from a pipette 25 ml. of the standard potassium bromate-bromide solution. Add immediately 10 ml. of potassium iodide solution and titrate with the sodium thiosulphate solution until the solution clears slightly.[11] Add 2 ml. of the starch solution and titrate to the disappearance of the blue color.

The percentage of magnesia may be calculated as follows:

If

A = g. of MgO per ml. of the standard thiosulphate solution.

B = ml. of thiosulphate solution equivalent to 25 ml. of the bromate-bromide solution.

C = ml. of thiosulphate solution required for titrating the precipitate.

Then

$$(B - C) \times A = \text{g. of MgO}$$

For example

If 25 ml. of the bromate solution required 49.85 ml. of 0.1008 *N* thiosulphate solution and 13.45 ml. of the thiosulphate solution were required for titrating the precipitate, the percentage of magnesia in a 0.5 g. sample would be calculated thus:

$$(49.85 - 13.45) \times 0.000508 = 0.0185 \text{ g. MgO}$$

$$0.0185 \times \frac{100}{0.5} = 3.70 \text{ per cent MgO}$$

---

[10] If a mechanical stirrer is not available the following procedure may be substituted at this point: Heat the filtrate to 60 to 70 deg. C. and add 4 ml. of ammonium hydroxide (specific gravity 0.90) per 100 ml. of solution. Then add 40 ml. of 8-hydroxyquinoline solution and heat to boiling. As soon as the solution boils, set it aside until the precipitate settles, filter, and treat as in the recommended procedure.

[11] The reactions involved in the titration are as follows: Hydrochloric acid reacts with the potassium bromate-bromide solution liberating free bromine according to the equation—

$$KBrO_3 + 5KBr + 6HCl = 6KCl + 3H_2O + 3Br_2$$

The free bromine reacts with the 8-hydroxyquinoline in solution forming dibromohydroxyquinolate, as follows—

$$C_9H_7OH + 2Br_2 = C_9H_5OHBr_2 + 2HBr$$

On addition of the potassium iodide solution the excess of free bromine is replaced by free iodine which is titrated with a standard solution of sodium thiosulphate.

EDITORIAL

Disposing of Michigan's White Elephant

THE state-owned cement plant at Chelsea, Mich., has virtually passed into history.

The measure recently passed by the state legislature directs that an effort shall be made to sell the plant. If it is not sold by July 1, 1934, it shall be scrapped. In the meantime no effort shall be made to manufacture cement unless the prevailing market price indicates that a saving to the state can be realized.

No one expects that any attempt will be made to manufacture cement under the conditions imposed, for time is required to build up a manufacturing organization and personnel that will operate with any approach toward efficiency.

With all its turbulent career, the Chelsea plant has served a good purpose. It has again demonstrated the folly of governmental ventures into manufacturing enterprises, and the demonstration has been staged right in the field of cement manufacture.

It is doubtful that even the combined ignorance of a state legislative body can hereafter succeed in presenting the taxpayers of a state with a white elephant of this breed.

No Time for Smug Assurance

IN an address delivered not long ago by Dr. Julius Klein, assistant secretary of commerce, he proposed what he termed a post-depression decalogue, in which several items have peculiar application to the cement industry.

"Don't ignore the amazing power of the new technology," he said in the fifth of his ten points. "No peril is quite so disastrous in business these days as a smug, self-satisfied assurance that present technique in production will be permanent. Our engineers, our chemists, our inventors, have never shown such relentless zeal as at present. They have largely been responsible for lifting the country out of every preceding crisis. Those industrialists who cling closely to them right now will have good reason to be thankful."

As was pointed out in the editorial, "The Price of Progress," in the April issue of the Cement Mill Edition of "Concrete," these technical men are never content with things as they are. From all the great industrial countries of the world they gather new ideas from which they develop new equipment, new methods, and new processes. Boiled down to its practical application, their particular problem is concerned with producing an improved product at lower cost. They have done their work well in the past, and there is every reason to think they will continue to do so in the future.

It is logical that improvements should be pushed vigorously at the present time. Those who consider this statement academic would do well to glance through the articles and news items in our recent issues. They will soon learn that the more progressive units of the cement industry are at this moment improving their processes, or installing long kilns, or improving their shipping facilities, or building plant additions, or installing dust recovery equipment, or rehabilitating their grinding departments.

The present time, of all times, is no time for sitting tight. The plant management which attempts it will find itself completely out-distanced when finally the true situation is realized.

Making Trophy Dedications Outstanding Events

NEWSPAPERS and newspaper clippings that reach us almost daily indicate clearly that the men who are responsible for the fine safety record in cement mills are also fully alive to the value of letting the world know about it.

Probably by this time most of the 43 mills that won the 1930 safety trophy for operating throughout the year without a lost-time accident have dedicated the trophy.

In these dedication ceremonies full advantage has been taken of the opportunity to build up community enthusiasm to a high pitch.

The ceremony in a southern Ohio city may be taken as typical. The event was made a community holiday. All the salesmen of the cement company were called in, and they joined the mill employes and executives in taking part in the dedication. An American Legion band supplied music, and hot-weather refreshments and sandwiches were handed out. The plant superintendent, the county judge and the district congressman made speeches that were not too long, but were full of old-fashioned enthusiasm. Heads of civic organizations, physicians, barristers and other men and women of local prominence sat on the platform. Local newspapers printed columns of pictures and reading matter. In short, the affair was made one of the outstanding events of the year in southern Ohio.

After such a ceremony it may be depended upon that this community is safety conscious.

In these days when so much thankless work is being accomplished by the safety enthusiasts in cement mills, let us pause long enough to tell them that they are doing a splendid piece of work in a splendid way.

Detailed Story of Operating Methods at Giant's Reliance Quarry

Crushing, Drying, Mixing and Grinding Operations at Plant Near Egypt, Pa.—Repair Shop and Power Sub-Station Equipment—Detailed and Summarized Cost Data

By S. G. McANALLY
Chief Chemist,[1] Giant Portland Cement Co., Egypt, Pa.

The June installment of this paper described the operations in the quarry, and transportation of the quarry product to the crusher.

This article, comprising the concluding half of the paper, deals with the preparation and handling of the raw material from the primary crusher to the final grinding. Complete cost figures are included.—The Editors.

As stated in the June installment of this paper, the data here presented comprise one of a series of papers describing mining and crushing methods and costs at cement plant quarries throughout the United States. Specifically, this paper describes the methods employed and costs obtained at the Reliance quarry of the Giant Portland Cement Co. at Egypt, Pa.

Crushing Plant

The primary crusher at the Egypt plant of the Giant Portland Cement Co. is located below the level of the tracks and rests on a solid rock foundation. Figure 5

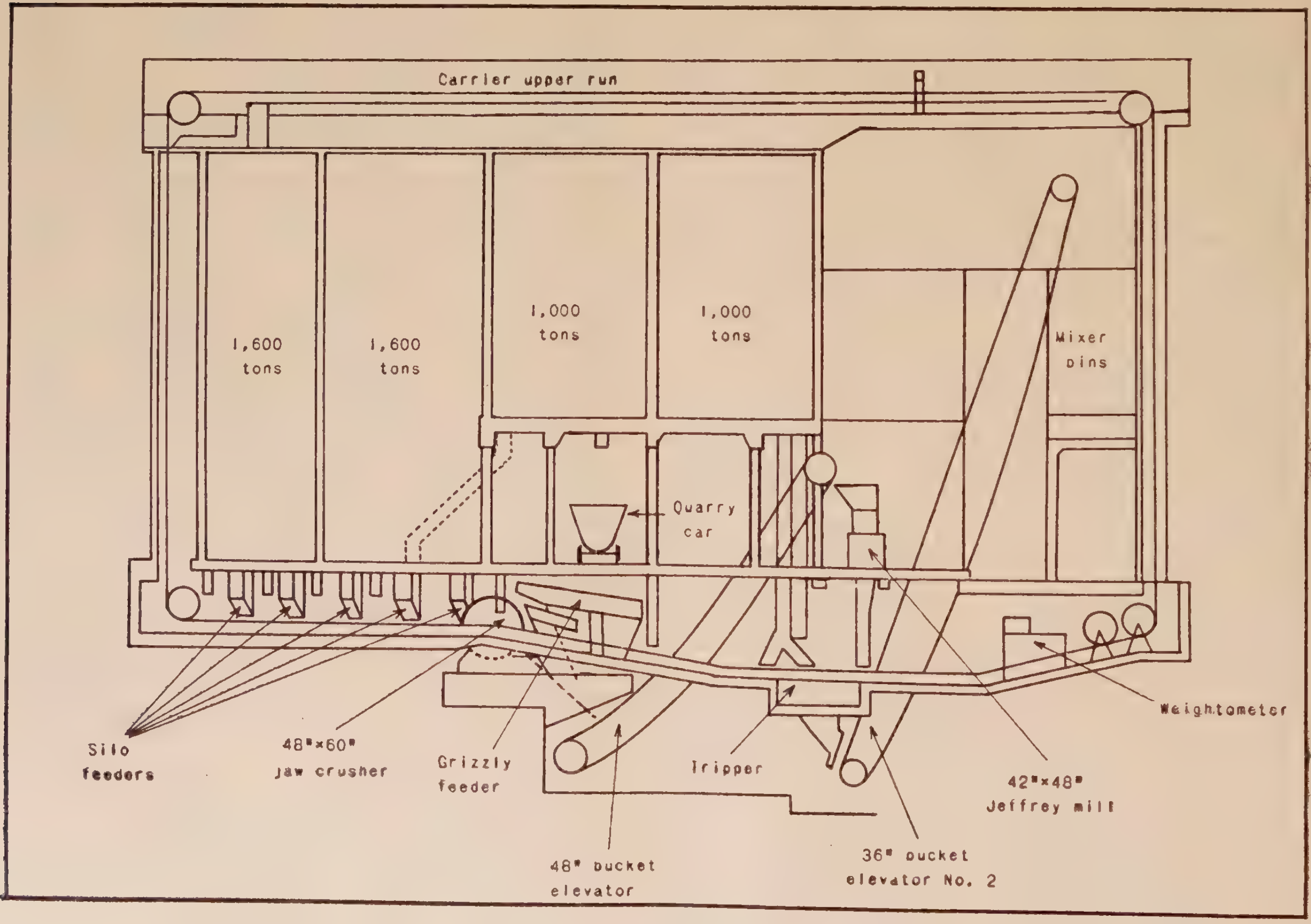


Figure 5. Sectional view of silos and crushing plant.

Reprinted from U. S. Bureau of Mines Information Circular 6448.

[1] One of the consulting engineers, U. S. Bureau of Mines.

is a sectional view of the silos and the crushing equipment.

A small drum hoist geared to a 15-hp. motor is used for unloading the cars. The lift is applied through an overhead block and tackle. The cars are dumped directly onto a 5 by 12-foot Traylor Sheridan grizzly feeder which is driven by a variable-speed 25-hp. motor. The feeder has a reciprocating motion and carries the rock ahead slowly and uniformly to a 48 by 60-inch Traylor jaw crusher belted to a 200-hp. motor. The fines, 3 inches and under, pass through the grizzly bars. The by-passing of the fines, which contain most of the clayey material, prevents choking of the crusher. The capacity of the primary crusher is 250 tons per hour, crushing to 8 inches.

The crushed product and the fines which pass the grizzly are picked up by a 48-inch by 60-foot bucket elevator and delivered to the secondary crusher, a 42 by 48-inch Jeffrey swing-hammer mill direct-connected to a 200-hp. motor. No intervening storage bin is required. The Jeffrey mill is very efficient for crushing cement rock. In order to reduce dust losses in the dryer stack several of the mill hammers have been removed.

The secondary crusher product, 3 inches and under in size, drops through a side chute to the lower run of a Link-Belt carrier which is driven by a 50-hp. motor. The buckets are 30 by 36 inches and overlap each other. The capacity of the carrier is 300 tons per hour. The carrier passes over a Merrick weightometer which weighs and records the quantity of rock going to the storage silos.

There are eight round concrete silos (two rows of four) with an interstitial row star shaped. The storage capacity is 12,000 tons. One section of the silos is 65 feet deep (inside depth) and the other is 40 feet deep. The latter is built over the railroad tracks, and double duplex gates, 24 by 24 inches, are attached to the bottom of these four silos. This permits the crushed rock to be loaded into gondolas and shipped to the central mill of the cement company.

A traveling tripper is used for dumping the carrier buckets containing the crushed rock into any of the silos. A small back-geared drum hoist driven by a 2-hp. motor pulls the tripper in a counter direction to that of the carrier. The forward movement is effected by the pull of the buckets.

Blending Rocks When Drawn From Silos

The empty buckets descend at the rear end of the silos and travel through a tunnel under the latter. Under each silo there is a Link-Belt reciprocating feeder. The feeders are driven through chain drives and clutches from a line shaft which is driven by a variable-speed 10-hp. motor. They can be adjusted to withdraw the rock at a uniform rate from any number of silos at the same time. By feeding from several silos simultaneously, the rock is blended and the combined flow of material is more uniform in composition than that which entered the silos.

The feeders deliver the rock to the lower run of the carrier which conveys it to a point ahead of the secondary-crusher discharge chute. At this point a tripper dumps the blended rock into the boot or pit of a 36-inch by 96-foot Link-Belt bucket elevator (elevator No. 2, Fig. 5) driven by a 40-hp. motor. The empty carrier buckets travel a few feet forward and pick up the product of the secondary crusher as already described. In case of a shut-down of the carrier the product of the secondary crusher or the crushed rock in the two north end silos can be fed directly to the No. 2 elevator, which delivers the rock to the mixer bins.

In the crushing department there are five men and a foreman. The three silo men, one on each 8-hour shift, keep the mixer bins supplied with cement rock and limestone; the latter is stored in two of the silos. One man operates the upper tripper (which distributes the rock to the silos) and collects an average daily sample of the rock from the carrier buckets. The sixth man helps in the unloading of cars of limestone and does odd jobs.

Drying and Mixing

There are two reinforced concrete mixer bins each having a capacity of 200 tons. One is used for cement rock and the other for the crushed limestone. The mixing room is located under these bins. Here the cement rock and the limestone are proportioned to make the raw cement mixture. The bins are equipped with duplex gates through which the stone feeds into the hopper of the Toledo scale. The hopper is drop-bottom and discharges at a uniform rate onto a horizontal belt conveyor, 39 inches by 7 feet 3 inches, which carries the mixture to a 16-inch by 35-foot overlapping bucket elevator. The latter delivers the product onto another horizontal belt conveyor 36 inches by 14 feet, to be discharged into the cylindrical dryer. The head pulley of the latter conveyor is a 16-inch diameter magnetic separator which picks the tramp iron from the stone.

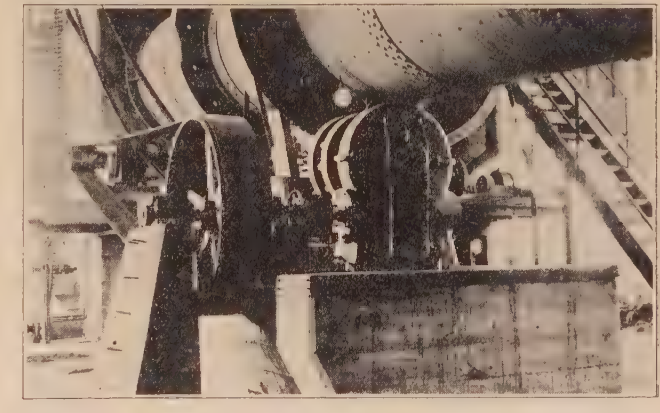


Figure 6. The 8 by 80-ft. dryer and auxiliary equipment are driven by a 75-h.p. motor through a speed reducer.

The dryer, 8 by 80 feet, is direct-fired by pulverized coal and can dry 67 tons per hour. Between 1,100 and 1,300 tons are dried each 24 hours. The dryer, the bucket elevator, the belt conveyors, and the auxiliary conveying equipment for cleaning the dryer stack chamber, are driven by a 75-hp. motor through a Cleveland Worm and Gear Co. speed reducer.

The dryer discharges directly into a 42 by 48-inch Jeffrey hammer mill direct-connected to a 75-hp. motor. Originally this mill was one of two installed for secondary crushing. One was found to be sufficient and the other was used to replace a smaller type of hammer mill at the discharge end of the dryer. The main purpose of this tertiary crushing is to break any stray large lumps of stone. The rock is reduced to under 1-inch size and discharges into an inclosed 17-inch by 40-foot bucket elevator which elevates it to a large rectangular steel bin located over the preliminary grinding mills. The bin has a capacity of about 100 tons.

There are three men in the mixing department, one man on each shift of 8 hours. There are no men in the drying department. The dryer, once started, requires little attention, and that is given by the men in the grinding department.

TABLE 1—*Summary*

	Cost per ton
Stripping	$0.05599
Primary drilling and blasting	.06606
Secondary drilling and blasting	.00855
Loading	.07454
Transportation	.05258
Primary and secondary crushing and storage	.07720
Drying, mixing, tertiary crushing and grinding	.36378
Total	$0.69870

TABLE 2—*Stripping*

Labor	$0.03627
Purchasing power	.00004
Fuel	.00467
Other supplies	.01500
Total	$0.05598

TABLE 3—*Primary Drilling and Blasting*

Labor	$0.01015
Explosives	.04571
Fuel	.00206
Other supplies	.00814
Total	$0.06606

TABLE 4—*Secondary Drilling and Blasting*

Labor	$0.00600
Explosives	.00250
Other supplies	.00005
Total	$0.00855

TABLE 5—*Loading Stone (Shovels)*

Labor:	
Operating	$0.02200
Repair	.00450
Pitmen	.00560
Cleaning quarry	.00088
Teaming	.00375
Foreman	.01082
Purchased power	.00030
Fuel	.00973
Other supplies	.01696
Total	$0.07454

Grinding

The preliminary grinders are two Bradley Hercules mills. Each is direct-connected to a 300-hp. synchronous motor. The mills are equipped with 9-mesh screens and have an output of 40 long tons per hour per mill.

Screen Analysis of Preliminary Grinder Product

Mesh	Per cent undersize
200	54.2
100	62.4
80	68.1
50	75.0
30	88.2
20	98.5
10	100.0

The ground material discharges into a 24-inch by 45-foot bucket elevator. The latter discharges into a 24-inch by 60-foot screw conveyor which distributes the

TABLE 6—*Transportation*

	Cost per ton
Labor:	
Operating locomotives	$0.02140
Repairing locomotives	.00481
Repairing tracks	.00239
Moving tracks	.00965
Repair material:	
Locomotives	.00346
Tracks	.00155
Moving tracks	.00032
Purchased power	.00030
Fuel	.00766
Oil and waste	.00104
Total	$0.05258

TABLE 7—*Primary and Secondary Crushing and Storage*

Labor:	
Operating	$0.04168
Repairs	.00293
Supplies:	
Operating	.00033
Repairs and maintenance	.01045
Oil and waste, tools	.00745
Fuel	.00063
Purchased power	.01373
Total	$0.07720

TABLE 8—*Drying, Mixing, Tertiary Crushing and Grinding*

Labor:	
Operating	$0.05449
Repair	.03649
Supplies:	
Operating	.00062
Repairs and maintenance	.03158
Tools	.00007
Oil and waste	.00753
Fuel	.02947
Purchased power	.20353
Total	$0.36378

TABLE 9—*Summary of Cost Distribution*

	Labor	Power	Fuel	Explosives	Other Supplies	Total
Stripping	$0.03627	$0.00004	$0.00467		$0.0150[illegible]	$0.05598
Primary drilling and blasting	.01015		.002[illegible]	$0.04571	.00814	.06606
Secondary drilling and blasting	.00600			.00250	.00005	.00855
Loading stone	.04755	.00030	.00973		.01696	[illegible]54
Transportation	.03825	.00030	.00766		.00637	[illegible]258
Primary crushing		.00574				
Secondary crushing		.00348				
Storage in		.00180				
Storage out	.04461	.00271	.00063		.01823	.07720
Mixing, drying		.01864				
Tertiary crushing		.00401				
Preliminary grinding		.04963				
Final grinding		.12824				
Conveying, etc.	.09098	.00301	.02947		.03980	.36378
Totals	$0.27381	$0.21790	$0.05422	$0.04821	$0.10455	$0.69869

TABLE 10—*Man-Hours*

	Man-hours per ton	Tons per man-hour
Stripping and drilling	0.13900	7.19
Loading and transportation	.12608	7.93
Crushing	.11696	8.55
Drying and grinding	.17914	5.58

material into a steel blending bin. The elevator and conveyor are chain-driven from a Palmer-Bee Co. speed reducer coupled to a 25-hp. motor. There are five discharge openings in the conveyor casing. The first four are equipped with steel slides which are operated by an electrical device that opens and closes them in rotation. This insures a uniform distribution of the material entering the blending bin. The lower section of the bin consists of five hoppers, the centers of which are directly under the conveyor openings. Under the hoppers there are five rotary valves driven through chain drives from a line shaft. The valves withdraw the mix from the bin at a uniform rate and the five streams feed into an 18-inch by 50-foot screw conveyor. This discharges into a 17-inch by 25-foot bucket elevator which in turn discharges into an 18-inch by 66-foot screw conveyor which feeds the tube mills. The valves, the two 18-inch screw conveyors, and the last elevator are all driven by a 25-hp. motor through a Palmer-Bee Co. speed reducer.

There are two tube mills for the final grinding of the raw mix. One is a 7 by 26-foot Traylor and the other is a No. 20 7-foot by 23-foot 6-inch Smidth. The former is driven by a 500-hp. synchronous motor; the latter by a 400-hp. synchronous motor. The mills are charged with ¾-inch steel balls and cylpebs. The charge in the larger mill is 35 tons; in the smaller mill, 24 tons. The combined output of both mills is about 50 tons per hour. Ninety per cent of the product passes a 200-mesh screen.

The grinding department operates 24 hours per day, seven days per week. Six men, two on each 8-hour shift, are employed in this department.

Repair Shop

There is a large and well-equipped repair shop, at one end of which is the blacksmith shop. A 12 by 10-inch Pennsylvania Pump and Compressor Co. compressor supplies the air for the jackhammers and for miscellaneous purposes. An Armstrong bit dresser for the well-drill bits and a Denver Rock and Drill Co. bit dresser for the air-drill bits are parts of the blacksmith shop equipment.

Repairs on the shovels and the locomotives are made without delay. The men operating these units work on a bonus system and the equipment for mining and transportation is kept in good condition at all times. All boilers are cleaned out every two weeks.

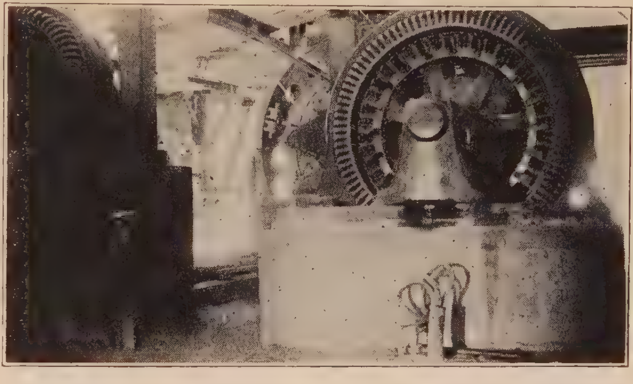


Figure 7. Two tube mills, one 7 by 26 ft. and driven by a 500-h.p. synchronous motor, the other 7 by 23½ ft. and driven by a 400-h.p. synchronous motor, have a combined output of 50 tons per hour.

Power

Electrical power is purchased from the Pennsylvania Power and Light Co. The substation equipment consists of two 3,000 kva. transformers and two 100-kw., 220-volt, direct-current motor generators. The incoming power is stepped down from 66,000 to 440 volts.

Pay System

The men employed on stripping, primary drilling and blasting, and in the crushing and grinding departments are paid a straight hourly wage. The crew engaged in transportation, loading, and unloading of the cement rock is paid an hourly wage and a bonus. There are 16 men included in the bonus distribution. The bonus is based on a fixed labor cost and the actual labor cost for transportation, loading and unloading. A maximum labor cost of 8 cents per long ton is the present fixed standard. The difference between the maximu[illegible]d the actual labor cost is paid to the [illegible]

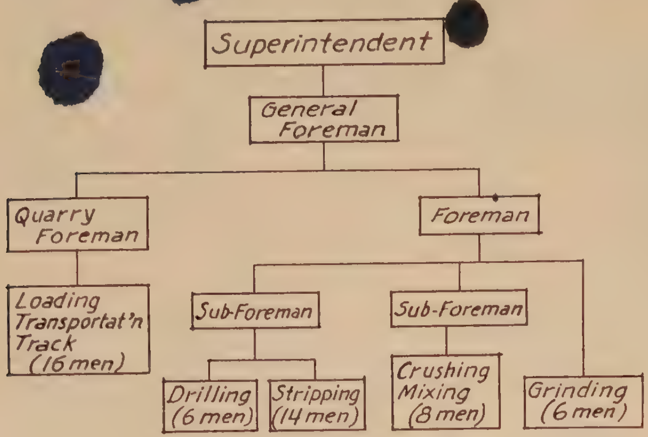


Figure 8. Organization chart.

The wage scale is as follows:

Position	Number	Rate per hour
Shovel enginemen	3	$0.53
Shovel firemen	3	.47
Shovel cranemen	3	.48
Well drillers	3	.495
Well drillers' helpers	3	.425
Drillers (jackhammer)	2	.505
Pitmen	2	.45
Locomotive enginemen	5	.51
Trackmen	2	.465
Men on waste dump	4	.40
Pick and shovel men on stripping	6	.40
Blacksmith	1	.60
Tripper man (mill)	1	.45
Silo men	3	.46
Mixer men	3	.425
Millers	3	.58
Millers' helpers	3	.53
Subforemen	2	.58

Cost Data for 1929

Production of stone (short tons)	288,528
Overburden removed (cubic yards)	26,956

Manufacturers Plead Seaboard Markets Lost to Domestic Product

Pleas for substantial increases and for decreases in cement duties were made before the Tariff Commission at Washington, D. C., on June 11, as it concluded the hearing ordered by a Senate resolution. Producers were given 30 days in which to file briefs, the *United States Daily* reports.

Appearing for the Alpha Portland Cement Company, Easton, Pa., F. M. Coogan, vice-president, said foreign as well as domestic markets were lost because of the company's inability to meet the prices of foreign mills. Dr. Kemper Simpson, counsel for the importers, brought out in cross examination that the loss of the Porto Rican market by the Alpha company was due to competition from Denmark, which, he said, enjoys advantages in freight rates.

W. T. Miller, representing a Boston importing firm, brought out that in some cases foreign cement is discriminated against because of ordinances requiring domestic material.

James H. Ackerman, vice-president, Lawrence Portland Cement Company, New York City, testified that his company, after making concessions to dealers in Boston of 45 cents per barrel to meet foreign competition, was forced to withdraw from active solicitation of business in that territory. The loss of business resulting from Belgian competition caused the company to shut down half of its plant in Thomaston, Me., in 1928, he said.

James C. Bradshaw, representing James C. Goff Company, building material dealers, Providence, R. I., testified that numerous building contracts were lost by American cement because of the lowered price of the imported product.

John C. Bowen, vice-president, Lehigh Portland Cement Company, New York, said his company had to reduce prices in the entire territory around Boston and Providence because of foreign pressure. The Porto Rican market has been lost because of inability to meet foreign competition, he said.

Testimony that foreign cement has disturbed the competitive situation in the Gulf States was presented by J. W. Johnston, vice-president, Lone Star Cement Company of Alabama, and L. R. Ferguson, vice-president, Lone Star Cement Company of Texas.

T. K. Partridge of the Southwestern Portland Cement Company, Los Angeles, Calif., asserted that in his area also the effect of foreign competition has been felt. He said that Belgian clinker had been imported and ground and sold at a lower price than domestic cement.

Dr. Simpson brought out through examination of Mr. Partridge that the agreement whereby the Southwestern Company arranged to supply the Blue Diamond Company with domestic clinker was to eliminate foreign competition and discourage any potential clinker grinding mills.

The cost of clinker represents 85 per cent of the finished cement, M. A. Koffman, also of the Southwestern Company, testified.

In closing his case for the domestic manufacturers, Mr. Barnes declared that the industry believes that the duty of 23 cents per barrel imposed by the 1930 Tariff Act is "totally inadequate" and asked that the rate be increased to 36 cents per barrel. The industry does not complain of the volume of imports, he said, but does not believe it a healthy condition wherein such imports so materially affect the domestic price situation. The testimony presented before the Commission, he stated, shows the weighted average cost of domestic cement delivered at the principal markets to be $1.98 while that of imported cement is $1.47.

Abrams Opens Consulting Practice; Leaves International

Dr. D. A. Abrams, director of research for the International Cement Corporation, has resigned from that organization for the purpose of opening a consulting office in New York.

The Use of Parallel Connections for Electric Blasting

Buss Wires Employed in Making Connections—Fewer Misfires from Electrical Trouble Than with Series Connections—Amount of Power Current Required

By CHARLES S. HURTER, S.B.
Technical Representative, E. I. du Pont de Nemours & Company, Inc.

As the advantages of connecting electric blasting caps in parallel become better known, the adoption of this system of connection in tunnels, where power current is available, is coming into greater use. Foremost among these advantages is the avoidance of misfires, due to current leakage from the leg wires, which are likely to occur with a series connection, especially in wet work.

How Parallel Connections Are Made

The simplest and easiest method of making parallel connections is by means of buss wires. These buss wires consist of bare copper wires strung across the face, the size usually recommended being No. 14 B. & S. gauge. In a smaller heading No. 16 gauge may sometimes be used. To support these wires, wooden plugs are placed in the collars of two holes on each rib. While these plugs must be firmly fixed in the holes, care must be taken not to damage the leg wires of the electric blasting caps. In 8 by 8-ft. headings, a plug in each of the top relief holes will support one buss wire and another plug in each of the lowest relievers will support the other. One bare copper wire is wound firmly around one of these wooden plugs, stretched horizontally to the plug on the other side of the face, wound around this and fastened so as to hold the buss wire tight. The other bare copper wire is stretched between the two lower plugs in the same manner.

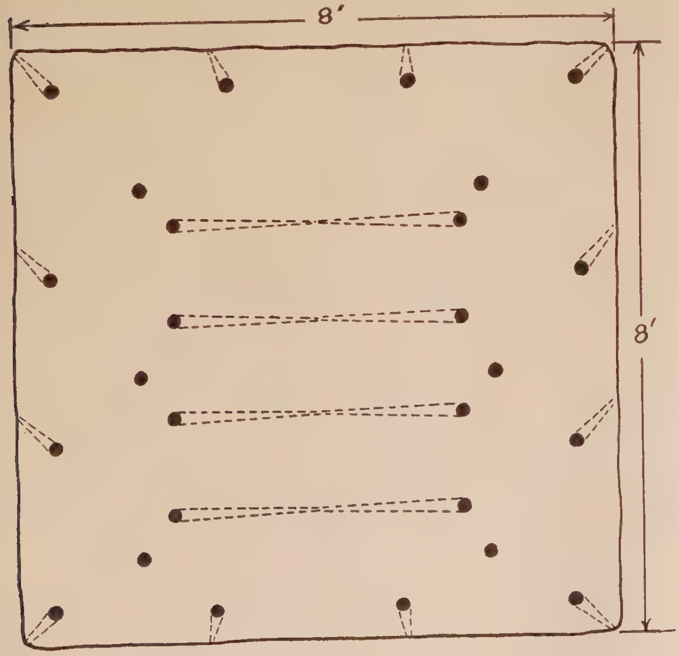


Figure 1. Typical tunnel heading round.

When the buss wires are in place, one leg wire from each electric blasting cap is connected to one buss wire and the other leg wire is connected to the second buss wire, thus making a complete parallel connection of all electric blasting caps in the face. When this is finished, the leading wires are connected to diagonally opposite ends of the buss wires. The use of buss wires permits making tighter joints and hence a more effective circuit than is ordinarily secured by bunching the different leg wires and connecting them direct to the leading wires in parallel.

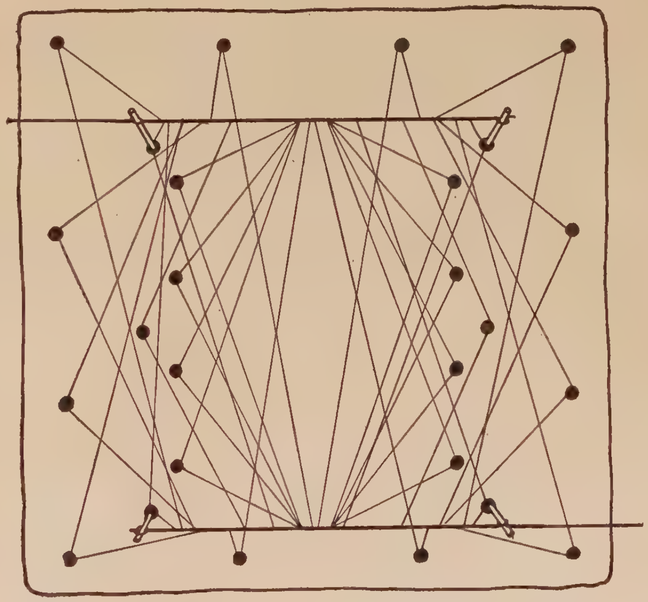


Figure 2. Method of connecting electric detonators in such a round in parallel to buss wires supported on wooden plugs fixed in the collars of two relief holes on each side of the heading.

Use of Two or More Sets of Buss Wires

In large faces it is often more convenient to have two, or, occasionally, even more than two sets of buss wires. These sets of busses should be connected in parallel to the leading wires. Where more than one set of busses is used an equal number of electric firing devices should be connected to each set. Otherwise the group having the smallest number of electric detonators will get the most current, fire first and possibly cut out the larger groups. If there is any unevenness in the size of the groups, there should be no instantaneous electric blasting caps in the smallest group. Where the heading is bone dry two busses can be fastened to the same plugs with a space of six to eight inches between them. But if there is any possibility that the plugs will get wet, or even moist, between the time of loading and firing this should not be done as the chance that electric current may leak along the plug from one buss to the other is too great.

Power Current to Be Used

It should be kept in mind that with parallel connections a minimum of 0.6 amperes should be provided for each electric blasting cap or delay electric blasting cap and that power current should always be used. Electric blasting machines are designed for use with series connections only.

Parallel connections may take a little longer to make than series connections, but experience has shown that, year in and year out, there are fewer misfires from electrical troubles when the parallel system is used. It completely removes the possibility of failures due to current leakage from the leg wires connected in series.

Governor Signs Bill for Sale of Chelsea State Cement Plant

Governor Brucker of Michigan on June 6 signed the bill authorizing the state administrative board to sell the state-owned cement plant at Chelsea. The bill provides that if the plant has not been sold by 1934, it shall be dismantled and the salvage and land sold separately.

The plant has been closed since March. The 175,000 barrels of cement in storage will remain there until higher prices are in effect. In the meantime, cement will be purchased from private manufacturers.

Early June Sees Reopening of More Plants

Cement plants continued the customary Spring resumption of operations early in June. Among those to reopen were the New Castle, Pa., plant of the Lehigh Portland Cement Company, where 100 men returned to work and which, it is expected, will continue to operate for several months, and the Castalia Cement Co. plant at Castalia, Ohio, which reopened on June 8.

The Universal Atlas Cement plant at Hannibal, Mo., began operation on a 35 per cent basis on June 8.

Keystone Begins Manufacture of Velroca Rapid-Hardening Cement

The Keystone Portland Cement Company, Philadelphia, Pa., has begun the manufacture of Velroca high-early-strength portland cement.

Charles E. Shearer is in charge of sales and promotion.

Texas Finds New Way to Harass Cement

(Editorial in Fort Worth Star-Telegram, May 24, 1931)

UNDER the heading "The Legislature Sets a Precedent," the Fort Worth "Star-Telegram" of May 24, 1931, makes the following editorial comment on the new Texas state tax of 5 cents per barrel on portland cement:

"The regular session of the Forty-second Legislature passed into history Saturday after contributing to the list of precedents one which no doubt will rise to plague the State many times in the future. The precedent was that of enactment of measures imposing new taxes without hearings and with a minimum of chance for deliberate consideration of the possible effects of departures from established practice in taxation.

Several new taxes were levied through last-minute amendments attached to unrelated bills by the Senate, despite the constitutional reservation to the House of the exclusive right to initiate revenue measures. One of these new taxes was the cement tax which was attached to the peddler's license bill in the last hours of the session. There were no public hearings held on the advisability of such a tax, the ability of the industry to absorb it without injury, or any other matters relating to new taxation which careful legislative bodies deem advisable for inquiry before a new tax is levied.

"Indeed, there was a minimum of discussion of the tax in any manner. Proponents merely said it was a good tax and that the cement mills were making 'plenty of money' with which to pay it. When opposition was encountered from other legislators, the tax proponents merely backed down little by little on the amount of the tax until the figure finally was one-eighth of that originally proposed, and having softened opposition in this manner, proceeded to drive the tax through. No opportunity was given to the cement industry to present evidence to support any protest which that industry might be entitled to make.

"Such procedure in taxation is highly dangerous. Not only does it preclude that open discussion which alone can be depended upon to bring out the facts, but it works a deep injury to the principle of popular government involved in the requirement that the revenue raising power shall be centered chiefly in that branch of the Legislature which is most representative of the various communities of the State. The House has a larger membership solely for the reason that it is designed to be the popular body. Yet in matters of taxation in this session we find the Senate, with a membership far smaller, in which must be absent the checks and balances arising from numbers alone, asserting greater authority in the levying of new taxes than the House."

Unveiling of the Trophy

Numerous dedication of trophies won by cement plants for no-accident records in 1930 took place during June, typical of which was that at the Birmingham, Alabama, plant of the Lehigh Portland Cement Company on June 3, when the above scene was presented.

Here a rededication of the award won for the 1929 record was made.

Reduction in June Accidents; 85 Plants Have Perfect Record for First Half of Year

Eight cement plant accidents up to June 20 are reported by the Portland Cement Association in its annual June campaign. This compares with a total of 28 in the entire month in 1930, with 41 in 1929, and 42 in 1928.

Eighty-five plants completed the first half of the year without accidents, thus becoming potential trophy winners.

New Books and Pamphlets

Financial Analysis of Cement Industry

Cement is the title of a printed financial analysis of the portland cement industry of the United States recently distributed by Amos C. Sudler & Co., investment bankers, Denver, Colorado.

The analysis contains comparative financial data pertaining to the leading companies of the United States and Canada and the location and capacity of the individual plants owned by those companies.

Another feature is a list containing the name and location of each individual cement plant in the United States —171 in all—arranged by states. Another page shows the locations of the same plants on an outline map of the United States.

Cement Chemistry in Theory and Practice

Cement Chemistry in Theory and Practice is the title of a recently published book by Prof. Dr. Hans Kühl, director of the Institute for Cement Research, Berlin, Germany. Translated into English by J. W. Christelow. Published by Concrete Publications, Ltd., London, England. Distributed in the United States by the Concrete Publishing Co., 400 W. Madison Street, Chicago. Cloth cover, 64 pages, 6 by 9 inches. Illustrated with a number of halftones and diagrams.

This work originally constituted a series of lectures delivered by Dr. Kühl in Moscow, at the special request of the Soviet Government. The work has aroused considerable interest among cement manufacturers in England and on the continent.

The book contains six chapters, and the subject matter treated includes:

(1) The Development of Cement Research.
(2) The Theory of Cement Burning.
(3) The Constitution of Portland Cement Clinker.
(4) The Problem of Hardening and Its Signification in Cement Research.
(5) The Chemistry of High-Strength Cements.
(6) The Technical Aspect of High-Strength Cements.

The last two chapters, dealing with the chemistry and technical aspects of high-strength cement, are alone of sufficient value to make this book a necessary addition to the personal library of chemical engineers associated with the portland cement industry.

Southern Chemical Progress

Chemical Progress in the South. First edition, September, 1930. Compiled by the Division of Chemistry and Chemical Technology of the National Research Council. Published by the Chemical Foundation, Inc., New York. Cloth, 282 pages, 6½ by 9½ inches, 26 illustrations.

The book contains four parts, the first of which deals with the educational institutions of the South, the second with the chemical problems of southern industries, the third with recent developments in chemistry in the South, and the fourth contains statistical information. A useful feature of Part IV is a check list of chemical periodicals in libraries of the South.

American Cement Directory

The American Cement Directory, 1931. Published by the Bradley Pulverizer Co., Allentown, Pa. Price $3.00. Special price to those in the industry.

Fresh off the press, the new edition of this annual directory is an up-to-date index of American and American-owned cement plants. As in previous issues, the information given regarding each plant includes the location of the offices, the plants, names of officials, sales offices, capitalization, output, process of manufacture, and size and number of kilns.

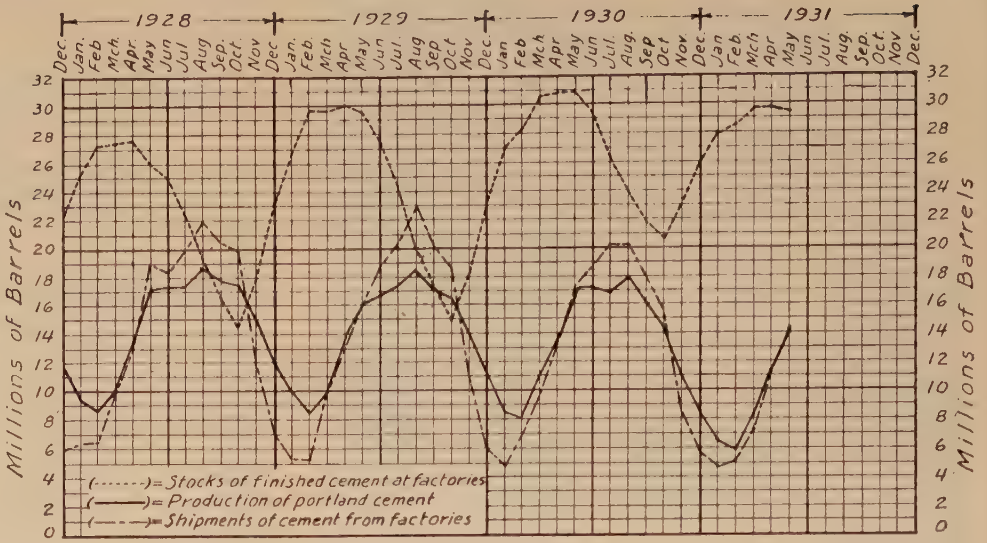
Cement Statistics for May

Highway Construction Sustains Southern States' Gains Over 1930

Relation of Production to Capacity

(Figures represent per cent)

	The Month	The Twelve Months
May, 1931	62.8	56.5
May, 1930	**78.9**	**66.2**
April, 1931	52.1	57.7
March, 1931	36.9	58.6
February, 1931	29.4	59.7



	1930	1931	Increase or Decrease, %
Production, May	**17,249,000**	14,006,000	—18.8
Shipments, May	**17,224,000**	14,222,000	—17.4
Stocks at end of month	**30,891,000**	29,447,000	—4.7

	1930	1931	Increase or Decrease, %
Total production for year	**58,655,000**	46,011,000	—27
Total shipments for year	**51,357,000**	42,364,000	—21
No. of plants reporting	**166**	165	—.6

Production, Shipments, and Stocks of Finished Portland Cement, by Districts, in May, 1930 and 1931, and Stocks in April, 1931

District	Production—May		Shipments—May		Stocks at end of month		Stocks at end of April,
	1930	1931	1930	1931	1930	1931	1931*
Eastern Pa., N. J. and Md.	**3,707,000**	3,053,000	**3,746,000**	2,952,000	**6,998,000**	6,826,000	6,725,000
New York and Maine	**1,176,000**	1,106,000	**1,191,000**	1,137,000	1,847,000	**2,044,000**	2,076,000
Ohio, Western Pa. and W. Va.	**2,112,000**	1,289,000	**1,974,000**	1,252,000	**4,102,000**	3,513,000	3,476,000
Michigan	**1,419,000**	722,000	**1,229,000**	825,000	**2,785,000**	2,482,000	2,586,000
Wis., Ill., Ind. and Ky.	**2,143,000**	1,913,000	**2,026,000**	1,743,000	**4,808,000**	4,378,000	4,208,000
Va., Tenn., Ala., Ga., Fla. and La.	1,306,000	**1,418,000**	1,192,000	**1,428,000**	**1,865,000**	1,630,000	1,639,000
Eastern Mo., Ia., Minn. and S. Dak.	**1,763,000**	1,335,000	**2,184,000**	1,538,000	3,628,000	**3,861,000**	4,064,000
W. Mo., Nebr., Kans., Okla. and Ark.	**1,360,000**	1,248,000	**1,390,000**	1,307,000	1,807,000	**1,827,000**	1,885,000
Texas	**630,000**	600,000	620,000	**644,000**	**836,000**	734,000	777,000
Colo., Mont., Utah, Wyo. and Idaho	**314,000**	296,000	290,000	**300,000**	563,000	**596,000**	600,000
California	**926,000**	699,000	**980,000**	730,000	**1,077,000**	1,027,000	1,058,000
Oregon and Washington	**393,000**	327,000	**402,000**	366,000	**575,000**	529,000	569,000
	17,249,000	14,006,000	**17,224,000**	14,222,000	**30,891,000**	29,447,000	29,663,000

Production, Shipments, and Stocks of Finished Portland Cement, by Months, in 1930 and 1931

Month	—Production—		—Shipments—		Stocks at end of month	
	1930	1931	1930	1931	1930	1931
January	**8,498,000**	6,595,000	**4,955,000**	4,692,000	27,081,000	**27,759,000**
February	**8,162,000**	5,920,000	**7,012,000**	5,074,000	28,249,000	**28,612,000**
March	**11,225,000**	8,245,000	**8,826,000**	7,192,000	**30,648,000**	29,676,000
April	**13,521,000**	11,245,000	**13,340,000**	11,184,000	**30,867,000**	*29,663,000
May	**17,249,000**	14,006,000	**17,224,000**	14,222,000	**30,891,000**	29,447,000
June	17,239,000	....	18,781,000	....	29,364,000	....
July	17,078,000	....	20,153,000	....	26,289,000	....
August	17,821,000	....	20,299,000	....	23,824,000	....
September	16,124,000	....	18,083,000	....	21,889,000	....
October	14,410,000	....	15,599,000	....	20,697,000	....
November	11,098,000	....	8,784,000	....	23,056,000	....
December	8,480,000	....	5,688,000	....	25,883,000	....
	160,905,000	....	158,744,000	....	....	....

Blacker type indicates larger of two figures.
*Revised.

MEN and MILLS

Notes from the Field

Green Bag Cement Company New Name of Basic Products

The Basic Products Company on June 1 changed its name to the Green Bag Cement Company of West Virginia. Its product has been marketed as Green Bag cement.

General offices are located in the Oliver Building, Pittsburgh, Pa.

Pearson Succeeds Ashton on Joint Committee

J. C. Pearson of the Lehigh Portland Cement Co., Allentown, Pa., has been appointed as one of the Portland Cement Association representatives on the Joint Committee on Specifications for Concrete and Reinforced Concrete.

He succeeds Ernest Ashton, formerly vice-president of the Lehigh Portland Cement Co., who has resigned.

Alpha Men Entertain Rotarians

F. W. McElroy and Howard S. Klein of the Alpha Portland Cement Company on May 14 talked and presented a cement manufacturing firm before the Woodbridge, New Jersey, Rotary Club.

Traynor Tells Trade Possibilities with Canal Zone

Frank M. Traynor, general manager of the Florida Portland Cement Co., recently addressed the Rotary Club of Tampa on the possibilities of trade with countries of the Canal Zone area, from which he recently returned.

J. W. Kelly Leaves P. C. A.; Joins Sand and Gravel Association

J. W. Kelly, formerly associate engineer in the research laboratory of the Portland Cement Association, has joined the engineering and research division of the National Sand and Gravel Association, with headquarters in the Munsey Building, Washington, D. C. For the present he is located at Milwaukee, conducting a special investigation of Wisconsin sands and gravels.

Mr. Kelly was engaged for some years in conducting special classes in the proper proportioning, mixing and placing of concrete. These classes, sponsored by the Portland Cement Association, were held in all parts of the United States and Canada.

Dick Hardy Now Keeps the Cup

Dick Hardy, of the auditing department at the general office of the Portland Cement Association, won low gross score at the sixth annual spring golf tournament of the Portland Cement Association, held at Woodridge Golf Club, Lisle, Illinois, on Sunday, June 7.

Having won similar honors on two former occasions, Mr. Hardy now gains permanent possession of the administration cup, the prize awarded for this achievement. Hardy's score for 27 holes was 139, followed closely by W. D. M. Allan's score of 142.

The association cup, awarded for low net score in the handicap event, was taken by Bob Smythe. Honors for the lowest number of putts went to Bill Vinton, while Jack Hough took the proximity prize at the eleventh green, placing his drive 14 ft. 8 in. from the hole. The proximity prize at the seventeenth green went to J. C. Seely, with his drive placed 26 ft. 2 in. from the hole. E. F. Rawcliffe came through with the high gross score of 213 for 27 holes.

Shearer to Promote Velroca for Keystone Company

Charles E. Shearer on June 1 was appointed assistant sales manager of the Keystone Portland Cement Company, Philadelphia. His duties will include the promotion and sale of Velroca high-early-strength cement, a new product of the company.

Mr. Shearer was with the Atlas Portland Cement Company for a number of years in Philadelphia and Chicago, and following the sale of the Atlas Company to the United States Steel Corporation he became associated with the Pennsylvania-Dixie Cement Corporation.

New Location for Northwestern Company Offices

The Northwestern Portland Cement Company on June 1 opened new offices at Seattle, in the Northern Life Tower building.

Lewis Sims, Dewey Engineer, Suffers Skull Fracture

Lewis R. Sims, assistant chief engineer of the Dewey Portland Cement Company plant at Davenport, Iowa, suffered a slight fracture of the skull in an accident at the plant on June 11.

Mr. Sims was the author of the article on the plant's closed circuit grinding installation which appeared in the January issue of CONCRETE.

Meisnest, Formerly of Pacific Coast Cement, Heads Athletic Organization

Darwin Meisnest, formerly vice-president and director of the Pacific Coast Cement Company, Seattle, Washington, has become executive vice-president of the Washington Athletic Club of Seattle.

He has been in charge of the recent refinancing program of the athletic club as its vice-president.

Bondholders of the club named Mr. Meisnest to take over active direction of the organization.

Lawrence Expands Group Insurance to Health, Accident Benefits

The Lawrence Portland Cement Company, Inc., with main offices in New York City, has announced the expansion of its group insurance program to provide health and accident benefits for its employes. The new coverage, like the original group life insurance, is being underwritten by the Metropolitan Life Insurance Company.

Individual benefits, based on salary, range from $10 to $40 a week. These weekly payments will be made when an employe is unable to work due to sickness from any cause, or injury received while off duty.

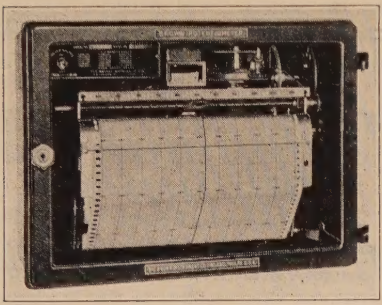
Besides the main office employes in New York, the coverage is extended to the workers in the branch offices in Philadelphia and Northampton, Pa.; Boston, Mass., and Thomaston, Me. Employes living in any of these cities are offered the advantages of a visiting nurse service when sick or injured and under the care of a physician. In conjunction with this a health advisory bureau regularly distributes pamphlets on disease prevention and health conservation.

Mill Equipment

Brown Instrument Company Develops New Potentiometer Pyrometer

A new Potentiometer Pyrometer in indicating, recording, multiple recording, and controlling types has been developed by the Brown Instrument Company, Philadelphia, Pa.

It is particularly suited for accurately measuring the temperature in rotary cement kilns, where the instrument can be operated from a radiation pyrometer tube focused on the interior of the kiln and the temperatures recorded or signalled on the new Brown Potentiometer Pyrometer.



The instrument may be also used to advantage in measuring the temperature of the gases leaving the kiln in which a thermocouple is located in the base of the stack and operates the Pyrometer.

Some of its 55 important features, as pointed out by the Brown Company, are as follows:

The galvanometer is designed to have a uniformly high responsiveness under all practical operating conditions.

The charts and scales 12 in. wide were produced with great care to conform to the latest calibration values for iron-constantan, chromel-alumel, and platinum-rhodium thermocouples. In order to derive full benefit from these carefully made charts, it is necessary to make suitable corrections for the natural expansion and contraction of the chart paper that takes place with changes in atmospheric humidity. It is because of this expansion and contraction that strip charts have oblong holes at one side of the paper.

The case is entirely enclosed and there are no openings through which the chart must extend. A re-roll attachment for the chart is standard and can be used if preferred, or the chart may be allowed to accumulate in the bottom of the case.

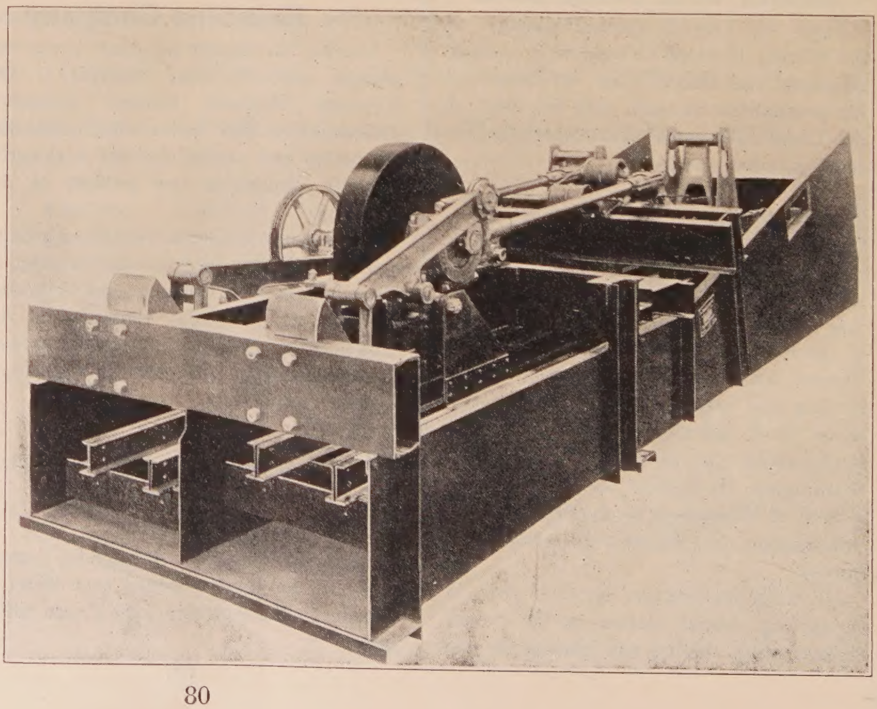
The galvanometer is completely enclosed in an inside compartment with a glass window, giving it full protection from mechanical injury and from air currents when the door is open.

New General Classifier Introduced by Dorr Company

The Dorr Company announces that it has introduced for general classification service a new and improved type of mechanical classifier, known as the Dorr F Classifier. The mechanical improvements in the design and the use of an entirely new and advanced type of head motion have greatly extended its field of application, and permitted the use of higher speeds than formerly possible, it is claimed. The use, where possible, of these higher speeds has been accompanied by a corresponding increase in sand raking and overflow capacities where these high rake speeds are consistent with the separation desired.

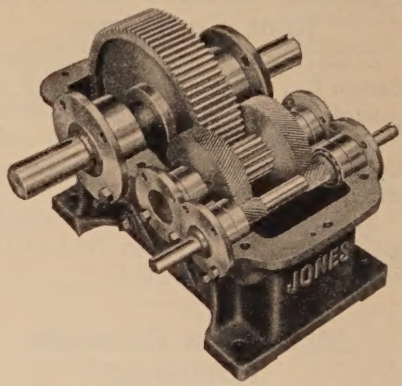
The Dorr F Classifier was developed and perfected in anticipation of changes in grinding and classification practice which have now materialized. The motivating influences in this instance were twofold; first, the definite tendency toward the maintenance of larger circulating sand loads in connection with closed-circuit grinding, and second, the trend toward coarser separations at the primary classification stage in multiple-stage, fine grinding. Both of these objectives are attained in the Dorr F Classifier.

The outstanding feature of this improved classifier is a distinctly different type of head motion, which is responsible for the machine's ability to operate smoothly and quietly at speeds 50 per cent greater than the maximum possible previously, it is said. Working parts are constructed of cast steel with a liberal use of pressure-lubricated bearings of the ball or roller type. Heavy welded construction is used throughout on the steel tank and on the reciprocating rake assemblies.



Smaller Herringbone-Maag Speed Reducers Developed by Jones

A new series of small Herringbone-Maag speed reducers has just been developed by the W. A. Jones Foundry & Machine Company, Chicago, Ill. Capacities range up to 18 h.p. Reduction ratios 12 to 1 up to 48 to 1. The smallest reducer in this series is 20 5/16 in. long and 14¼ in. high. The base measures 10¼ in. wide.



For universal application all the reducers in this series have high and low speed shaft extensions on both sides. This

GOODYEAR'S

expert skill with rubber puts this toughness in cement

CONVEYOR BELTS

OBVIOUSLY it saves for you to operate a Conveyor Belt built from a knowledge of the cement industry. Goodyear knows your conditions, and the Goodyear Belt is built to meet them. You get a rubber cover in the Goodyear Belt of proper toughness for abrasion from stone and clinker. You get scientific rubber compounds between plies for continuous flexing and tensions. What the requirements of the work call for you get in the Goodyear Belt with sure engineering skill. That is why these belts have hung up such fine service records for their owners in the industry—Goodyear's skill with rubber has put the work in them to save operating costs faithfully year after year.

The G.T.M.—Goodyear Technical Man—makes a careful study of your operation. He knows Transmission Belting and how to apply it for savings on your punishing drives. For rod and ball mills and kiln drives he will tell you of the new Goodyear THOR Belt in a stout seamless construction. He has helped many others in your line of work. He can do for you what he has done for them. To see him, just write to Goodyear, Akron, Ohio, or Los Angeles, California, and ask the G.T.M. to call.

THE GREATEST NAME IN RUBBER

GOODYEAR

BELTS ◆ MOLDED GOODS ◆ HOSE ◆ PACKING

eliminates the need of a right or left-hand assembly. Two shaft guards are provided.

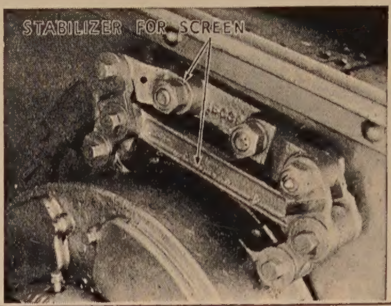
On the high speed side the Herringbone gears—and high speed pinion teeth—are generated by rack shaped cutters, with straight sides, used in a precision gear planer. On the low speed side the Maag spur tooth form is used because of the greater strength needed at this point.

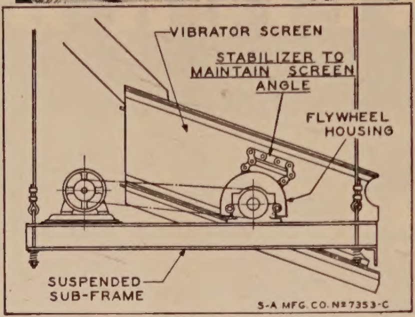
New Stabilizer for S-A Vibrating Screens Developed

What is said to be a unique stabilizer mounting for vibrator screens has been announced by Stephens-Adamson Mfg. Co. of Aurora, Ill.

In place of the usual balancing springs at the four corners of the screen, a simple stabilizer unit is now mounted upon one side of the frame to hold the screen at an unchanging angle. The screen is free to vibrate with the eccentric vibrating shaft, but it resists the usual tendency to rock or swing out of the proper screening angle, it is stated.

The stabilizer consists of two pairs of short arms, jointed elbow fashion and held parallel by a rigid cross bar. One end of each arm pivots on the flywheel housing, which is rigidly fastened to the heavy steel subframe. The other end of each arm is shackled to the screen body.





As can be seen, the two arms are free to swing or bend in any direction, but both must bend and swing together. Although in operation the movement of the stabilizer is very slight, it effectively prevents the tendency of a vibrating screen to buck and rock when sudden loads are received, it is stated.

The principal advantages claimed by Stephens-Adamson engineers for the new stabilizer, are:

1. The screen body is free to vibrate, but is held positively at the desired angle.
2. The screen angle is quickly adjusted to the most effective position by loosening two bolts on one side of screen.
3. The screen has no tendency to buck or rock.
4. Subframe vibration is decreased by eliminating the reaction of the usual balancing springs.
5. The stabilizer is sturdy and durable. All arms and brackets are of cast steel and the hinge pins are equipped with Nathan automatic oil feeders, which feed oil under constant pressure to the moving surfaces, one filling of oil lasting for several weeks.

About the Manufacturers of Equipment

INDUSTRIAL LITERATURE

T-Z Reduction Crusher

The features of the *T-Z* reduction crusher are presented in brief in a folder distributed by the *Traylor Engineering and Manufacturing Company,* Allentown, Pa.

The T-Z, it is stated, is a breaker of greatest capacity at smaller than usual setting and may be built into any gyratory crusher. The motor is laid horizontal to the frame of the machine, tending to give perfect balance with consequent easy handling, it is stated. Belts may be changed in a few seconds and can be supplied in any grit or degree of fineness, according to the manufacturers.

New Brown Catalog

The Brown Instrument Co., Philadelphia, Pa., has published a new catalog No. 1101 featuring a new line of potentiometer pyrometers recently introduced.

A 4-page folder printed in blue, silver and black is also being distributed.

The catalog is a 48-page book, well illustrated. It contains a short introduction outlining the nature and field of the potentiometer principle as applied to pyrometry, shows how this principle is incorporated in the new Brown potentiometer pyrometer, and follows this with a concise description of more than fifty features. The instrument is said to have a broad application to industrial needs involving the measurement and control of temperatures, especially in the higher ranges. Copy of this catalog will be sent to any executive by the Brown Company.

The folder is well illustrated, showing nine of the fifty features claimed for this new instrument. An excellent view of the complete instrument is shown on the first page of the folder, of which copies are also available upon request.

Belt Practice

Belt Practice is the title of a 40-page booklet issued by the *Diamond Rubber Company, Incorporated.* It is divided into two parts, the first concerning conveyor belt practice and the second, elevator belt practice.

The booklet is comprised of notes on "such practical features of design and maintenance as have a bearing on the welfare and life of the belt itself."

Field Activities

Dorr and Oliver Filters Merge

The Dorr Company, Inc., and *Oliver United Filters, Inc.,* on June 1 merged to form the *Dorr-Oliver Corporation.*

The Dorr-Oliver Corporation will function through its two wholly-owned operating units, a new Dorr Company, Inc., and a new Oliver United Filters, Inc. *John V. N. Dorr* and *E. L. Oliver* head their respective companies and with the aid of the former executive and technical staffs, are continuing on behalf of the Dorr-Oliver Corporation the businesses which were heretofore conducted individually.

The businesses of the two uniting companies are of long standing and complementary. The Dorr Company occupies one of the leading positions in the fields of agitation and classification, and the Oliver United Filters, Inc., occupies a similar position in the field of filtration.

Hardinge Co. to San Francisco

The Hardinge Company, whose headquarters are at York, Pa., has closed its Salt Lake City office and opened another at 235 Montgomery Street, San Francisco, Cal.